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Twenty-First Annual Metal Congress Issue

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THE IRON AGE

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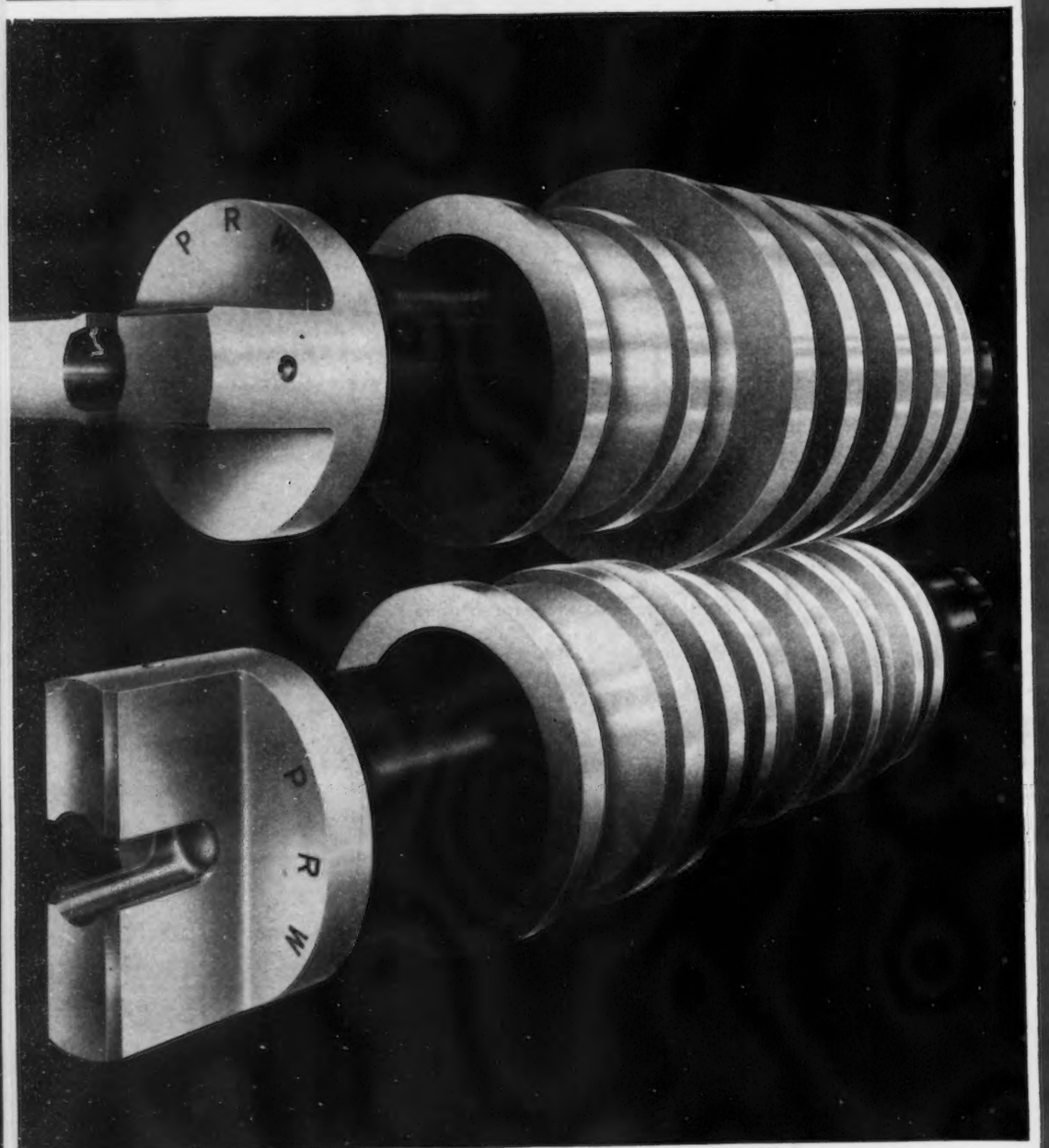

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OCTOBER 19, 1939

ESTABLISHED 1855 Vol. 144, No. 16

The Metal Congress, 1939

IF some malevolent despot had the will and the power to render America impotent, he could do it most effectively during the week of Oct. 23 to 28. All he would have to do would be to blanket the City of Chicago with some poisonous gas that would wipe out its population.

In so doing, this venomous potentate or dictator or devil would simultaneously wipe out a large part of the brains of the metal industries of America. For during that week the foremost metallurgists, mining engineers and welding engineers of our country will convene at the 21st annual Metal Congress.

It was not always called "Metal Congress" in name, but it has always been that in spirit, even back in the pioneer days of 1915, when William P. Woodside, current president of the American Society for Metals, gathered together in Detroit a small group of men interested in the heat treating of steel and formed the Steel Treaters' Club.

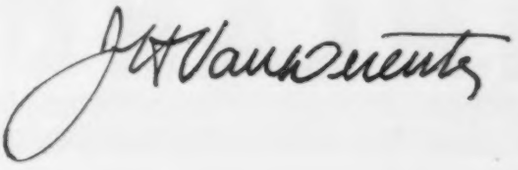
Several years later, after the club had expanded in membership and purposes, it was renamed the Research Club, and in 1917, having grown still further, it was christened the Steel Treaters' Research Society.

The parent organization, in 1918, formed a similar group in Chicago, to the detriment of the Elmhurst Public School System, which thereby lost its superintendent. For Ted Barker, president of the Chicago chapter, was also president of the Elmhurst, Ill., Board of Education. In 1919, Mr. Barker persuaded "Bill" Eisenman to quit his job of school superintendent to become the full-time secretary of the new organization.

In 1920, the organization became the American Society for Steel Treating. And in 1934, it was given its present name, American Society for Metals, which more completely described the enlarged aims and accomplishments.

The first convention and exposition of the Society was held in Chicago in 1919.

Despite the frequent change of name, the society has continued, from the start, unchanged in purpose. That purpose has been to stimulate and correlate the progress of metallurgy and its allied arts. So successfully has this been done that the Metal Congress, which was established by the American Society for Metals and which is participated in also by the American Welding Society and the American Institute of Mining and Metallurgical Engineers, has become an annual Mecca for the best brains of our metal industries.



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Phosphorus IN STEEL

° ° °

By C. H. LORIG and D. E. KRAUSE
Metallurgists, Battelle Memorial Institute

° ° °

LONG an element avoided and feared, phosphorus has, within recent years, been establishing a reputation for imparting corrosion resistance and improved physical properties to mild and low-alloy steels. What with interest in low alloy steels growing day-to-day, the first comprehensive report of the effect of phosphorus additions given herein is particularly timely, this being the first section of a two-part article.

° ° °

THROUGH the literature (see reference at end of second section, next week) it is now known that phosphorus serves in a useful capacity in mild and low-alloy steels by strengthening the steel and increasing its resistance to atmospheric and similar types of corrosion. Recognition of phosphorus as an important alloying element in steel is confirmed by the commercial acceptance of a number of steels to which this element is added in controlled amounts. This interest in phosphorus as an alloying element, long delayed by common prejudice against it as an embrittling impurity, has more recently stimulated experimentation to ascertain the properties that may be expected, and to determine suitable applications for the product.

The authors are herein reporting the results of a recent study of phosphorus-bearing steels sponsored at Battelle Memorial Institute by the Monsanto Chemical Co. This investigation represents a continuation of work which the authors reported in 1936[1] and offers confirmation of the benefits which can be secured by the addition of phosphorus alone or in combination with other alloying elements. In all, 77 steels were prepared in the metallurgical laboratories, upon which were determined the mechanical properties of rolled bar and sheet stock and the resistance to atmospheric corrosion of the sheet. For convenience the individual series will be separately discussed.

[1] C. H. Lorig and D. E. Krause, "Phosphorus as an Alloying Element in Low Carbon, Low Alloy Steels," Metals and Alloys, vol. 7, 1936, pp. 9 to 13, 51 to 56, 69-73.

Experimental Procedure

Standard metallurgical practice was followed throughout this study, both in the preparation of the steels and in the conduct of the various tests recorded. The melts were made in a high-frequency induction furnace and were of the killed type with an addition of 2 lb. of aluminum per ton. The ingots were rolled either to 22-gage sheets or to ⅞-in. square bars. Mechanical tests for strength and ductility were carried out on the sheets and bars while, in addition, notch-impact resistance was determined on the bars. The test results are reported for the steels in both the normalized and the annealed conditions. For both heat treatments standard practice was adopted for the various materials in question.

The authors believe that the test results obtained give a fair idea of the type of mechanical behavior and of the corrosion resistance of the alloys tested. The tensile properties are of interest in evaluating material for commercial fabrication processes and for many applications. The behavior of these steels in the notched condition was studied by means of a standard notched bar impact test and the results are generally reported as being either satisfactory or unsatisfactory, without attempting to ascribe too much significance to small differences in the actual impact values.

For corrosion testing, samples of the finished rolled sheet were either normalized or annealed, as the case might be, pickled in a hot 7 per cent sulphuric acid bath, scrubbed, rinsed, dried, and weighed. These samples were either 4 x 5½ in. or 4 x 5 in., at

approximately 22 gage. After preparation they were mounted in a vertical position on corrosion racks and exposed to the weather on the roof of the metallurgical laboratory at Battelle.

At the end of 6 months, 12 months, 18 months, 2 years and 3 years, successive groups of samples were taken out of the test and the corrosion loss determined for each of these periods. The samples were cleaned electrolytically in a 10 per cent sodium cyanide solution at a current density of 15 amp. per sq. ft., with the specimen as the cathode and a stainless steel sheet as the anode. This treatment loosened the rust coating so that it could be removed by moderate wire brushing. After cleaning and drying, the specimens were again weighed and the loss in weight determined in milligrams per square centimeter. There was nothing unusual in the methods used in conducting these tests; therefore, attention may be given at once to a consideration of the individual series that were studied.

Series A (Fe-P)

The alloys of Series A were made with an ingot iron base so that the total amount of elements other than iron and phosphorus was very low. The effect of phosphorus in increasing the resistance of iron to atmospheric corrosion, which the authors reported earlier[3] is confirmed by the present tests on this new series of specimens, though the extension of the time of testing to 2 and 3-year periods now permits an interesting distinction to be made between low-phosphorus and high-phosphorus steels. With low phosphorus (0.006 per cent P), rusting continues at approximately a constant rate throughout the entire 3-year period. High phosphorus materials (up to 0.57 per cent P) on the other hand, show a marked tendency to decelerate as time goes on. Resistance to atmospheric corrosion was found to increase with each increment of phosphorus, though the first additions were relatively more potent in their effect than were later additions. Thus, the 3-year weight loss for 0.006 per cent P was 82.5 mg. per sq. cm., while that for 0.12 per cent P was 58 mg. per sq. cm. and that for 0.57 per cent P was 39 mg. The weight losses over the 3-year exposure period for this series of irons are plotted in Fig. 1.

This series of irons showed a constant rise in tensile and yield strength with phosphorus. As a rule the yield strength rose proportionately more rapidly than the tensile strength producing, as a result, a high yield ratio in the high-phosphorus irons. Static durability represented by elongation and reduction in area fell very slowly with phosphorus content and up to 0.57 per cent P there was no sharp drop in ductility. The dynamic ductility or notch impact resistance represented by Charpy impact values on bar stock dropped sharply in the normalized irons when the phosphorus content was between 0.2 and 0.4 per cent. Normally the abrupt loss in notch impact resistance for such normalized alloys takes place at around 0.3 per cent P, but in this series no irons containing between 0.21 and 0.39 per cent phosphorus were examined.

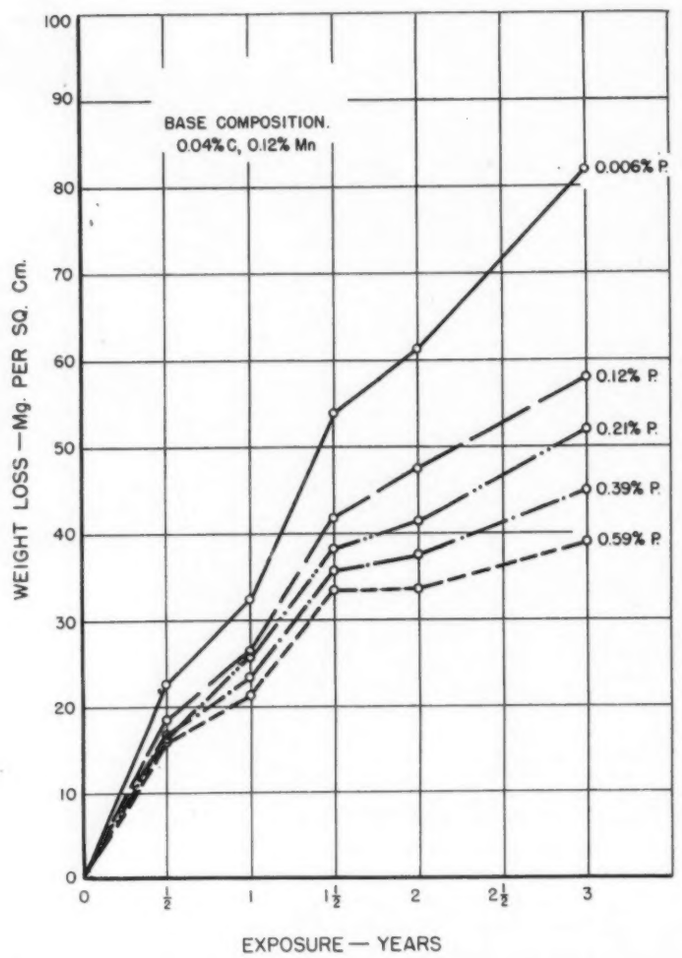

FIG. 1—Atmospheric corrosion losses at various time intervals over a three-year period for low-carbon iron of Series A, showing the effect of phosphorus on corrosion.

The annealing treatment used here lowered somewhat the limit in phosphorus content at which the abrupt loss in notch impact resistance occurred. This notch-embrittling effect of phosphorus in annealed iron and steel was reflected in a number of the compositions studied and it will be shown later that the addition of certain third and fourth elements has a definitely beneficial effect. In this regard, the tests further showed that, in some cases, beneficial and corrective effects upon notch impact resistance and other physical properties are derived from specific and proper heat treatment. The type of heat treatment effecting satisfactory notch impact in all of the higher phosphorus content steels studied was not determined in this research program.

Series B (Fe-P-C)

This series of five steels was made with a base composition of 0.5 per cent Mn, 0.10 Si, and 0.04 S. Both 0.12 per cent C and 0.24 per cent C steels are represented. In corrosion resistance this series repeated the behavior of Series A and, in addition,

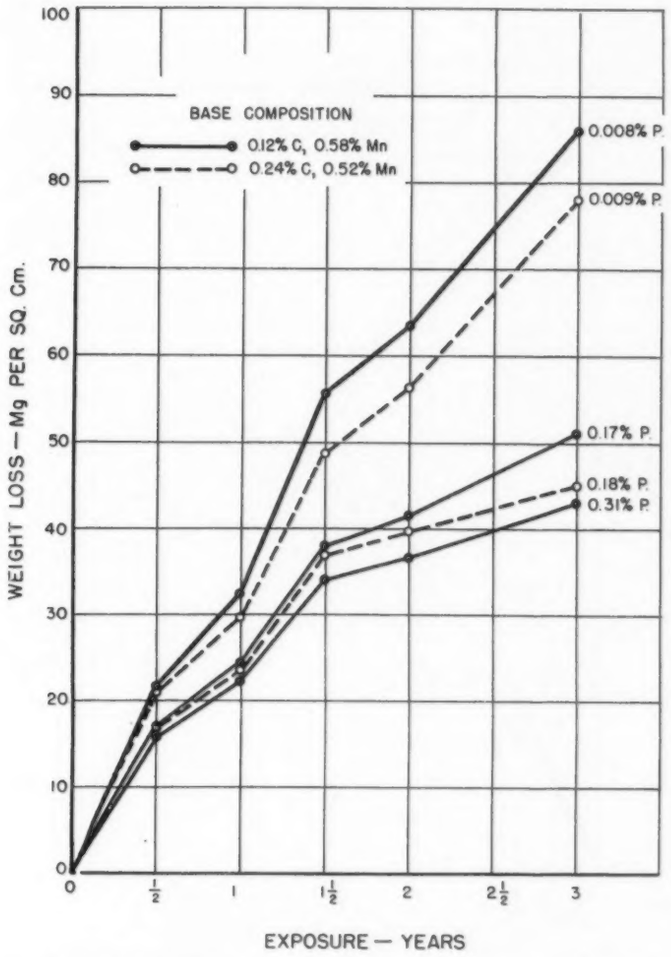

FIG. 2—Atmospheric corrosion losses at various time intervals over a three-year period for low-carbon steel of Series B, showing the effect of phosphorus on corrosion.

showed a slight superiority for the higher carbon steels. The corrosion data for these steels are shown graphically in Fig. 2. The higher phosphorus was very effective in reducing corrosion loss. Compared with irons of the "A" series, it would appear that neither the higher carbon nor the manganese in the steels affected the corrosion resistance. It is interesting to note that the steel with 0.12 per cent C and 0.17 per cent P was corroding only half as fast between the 18 months and 3-year periods as was the straight carbon or low-phosphorus steel. This determination was made by comparing the rates of corrosion after the rust coating had become well formed.

In the present series with 0.12 per cent C and 0.17 per cent P, there were secured a tensile strength of 65,000 lb. per sq. in., a yield strength of over 40,000 lb. per sq. in. and an elongation in 2 in. or 21 per cent on the 22-gage sheet. The elongation on the 0.505-in. test bar was 33 per cent. The Charpy impact value was still 30 ft.-lb. for the annealed condition. This would make it appear from the standpoint of notch sensitivity that a higher phosphorus content can be used in steel with low carbon content (0.06 to 0.12 per cent) than would be feasible in the iron of Series A.

It is possible to find an explanation for the foregoing in the fact that low-carbon steel, with somewhat higher carbon content and more manganese than the irons of series "A", is cleaner and contains less oxygen and hence is less notch sensitive in the range of 0.15 to 0.25 per cent of P. On the other hand, raising the carbon content still more will prove detrimental as it has been recognized for some time that phosphorus and carbon complement each other in affecting the notch sensitivity of steels. A balance between these two elements is sought, and in the present development of better and cheaper, low-alloyed, high-tensile steels it has become customary to limit the sum of the carbon and phosphorus to no more than 0.25 to 0.30 per cent.

Series C (Fe-P-Si)

Two steels were tested which had a base composition of 0.12 per cent C, 0.50 Mn, 0.40 Si and 0.04 S, the first with 0.008 per cent P and the second with 0.18 per cent P. The latter steel showed that phosphorus and silicon are an effective combination. Its tensile strength after being normalized was 75,000 lb. per sq. in. and its yield strength was 49,000 lb. per sq. in., with an elongation in 2 in. of 21 per cent for the 22-gage sheet and 35 per cent for the 0.505-in. test bar. The Charpy impact value was 31 ft.-lb., which is quite satisfactory. In the atmospheric corrosion tests the silicon was practically neutral in both the low and high-phosphorus steels. The corrosion results were approximately the same as they were for steels of the same phosphorus content of series "B"; hence, Fig. 2 may be consulted to show the trend in corrosion losses with time for this series.

Series D (Fe-P-Mn)

Two steels were tested to secure the effects of 0.009 and 0.18 per cent of P on a base composition of 0.12 per cent C, 1.3 Mn, 0.10 Si, and 0.04 S. The tensile properties were found to be materially enhanced by the addition of 0.18 per cent phosphorus. In the normalized condition the tensile strength was over 75,000 lb. per sq. in. and the yield strength over 50,000 lb. per sq. in. with over 20 per cent elongation in 2 in. In the annealed condition the strength was somewhat lowered, especially the yield strength. Manganese did not alleviate the notch brittle condition in annealed steels produced by high phosphorus.

In the atmospheric corrosion tests the high-phosphorus steel again showed excellent resistance, but this was not enhanced by the presence of manganese.

Series E (Fe-P-S)

Sulphur is known to accelerate atmospheric corrosion, particularly when it occurs as MnS. One steel of this series contained 0.14 per cent C, 0.80 Mn, and 0.10 Si and a higher sulphur content of 0.14 S. This steel corroded several times as fast as the corresponding steel with normal or low sulphur. In a steel with an equal amount of

phosphorus and sulphur (0.18 per cent), phosphorus was found to offset or nullify this harmful effect of sulphur giving a rate of corrosion which was approximately the same as though both phosphorus and sulphur were low. In this way it would appear to be possible, with free-machining steel, to restore at least normal corrosion resistance by the addition of phosphorus and at the same time to improve the machineability.

Again the tensile properties of both sheet and bar stock were found to be satisfactory for this grade of steel, although the high sulphur intensified the high phosphorus steels to notch sensitivity.

Series F (Fe-P-Cu)

The addition of copper to mild steel has long been practiced to improve the resistance to rusting in the atmosphere and more recently it has been noted that the combination of copper and phosphorus is particularly beneficial. This is borne out by this current work. For Series F, four steels were made, with compositions shown in Table I.

The tensile properties were good in all cases for both the annealed and the normalized conditions, though the steel with both high phosphorus and high copper in the annealed condition was weak in the Charpy test. The Charpy value of the normalized material was satisfactory. The low-copper steel, F-2, with 0.17 per cent P gave a tensile strength of about 66,000 lb. per sq. in. and a yield strength of over 40,000 lb. per sq. in. with an elongation in 2 in. of 21 per cent for the 22-gage sheet. When annealed this steel was somewhat weaker; however, its elongation in 2 in. was 30 per cent. This steel showed up to advantage in the corrosion tests (see Fig. 3) and after the rust film had become well formed it was corroding at a rate only 30 per cent as fast as the sample of mild steel. It will be noted that with low-phosphorus steels, the 1.17 per cent Cu steel is somewhat superior in corrosion resistance to the 0.35 per cent Cu steel. Both these steels are considerably more resistant to atmospheric corrosion than the plain carbon, low-phosphorus steel. Both types of steel show the same corrosion losses with phosphorus at 0.17 per cent. Copper enhances the influence of phosphorus though their combined influence on corrosion is not equal to the sum of their individual effects in plain carbon steel.

It may also be of interest that a precipitation hardening heat treatment

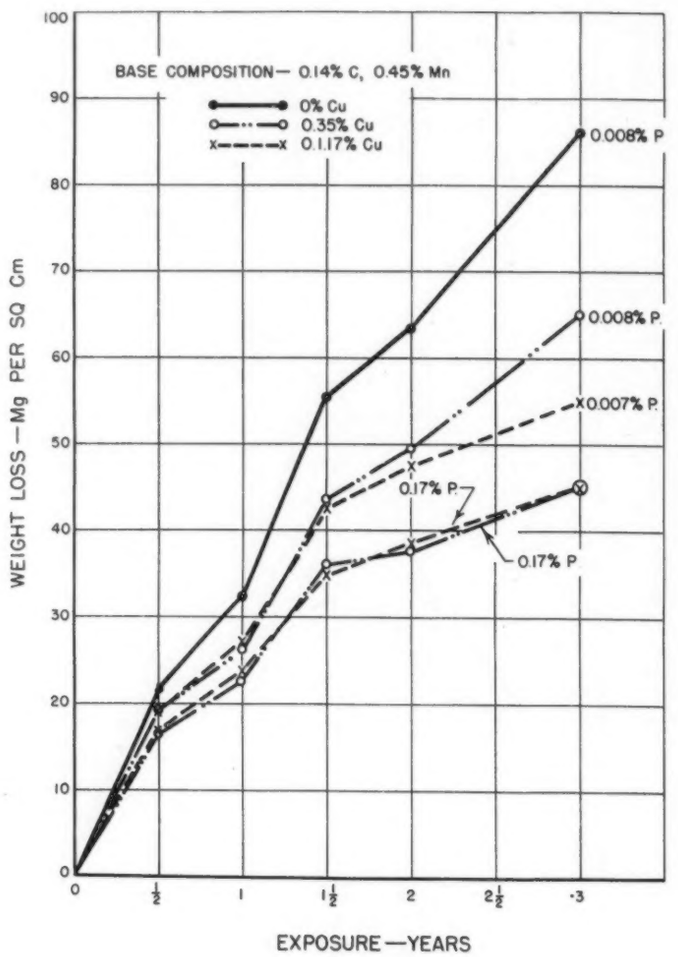

FIG. 3—Series F, low-carbon copper steel with phosphorus additions. These curves show atmospheric corrosion losses at various time intervals over a three-year period.

of the high-copper, high-phosphorus steel, F-4, gave a tensile strength of 91,500 lb. sq. in., a yield strength of 71,000 lb. per sq. in., and an elongation in 2 in. of 29 per cent for the bar stock. The Charpy value in this case was 19 ft.-lb., which is satisfactory.

Series G (Fe-P-Sn)

The addition of 0.19 per cent Sn was found to have only a small effect on the tensile properties of the low-phosphorus steel. It had a particularly unfavorable effect on annealed phosphorus-bearing steel by making the steel extremely weak in the notch-bar test. In the normalized condition this steel had good properties with tin appearing as a strengthening element. In the atmospheric corrosion tests tin in low-phosphorus steel was beneficial but in high-phosphorus steel was neutral in its effect up to 3 years.

Series I (Fe-P-Cr)

We have previously reported that the addition of 0.75 per cent Cr and over eliminates the extreme notch brittleness of 0.10 to 0.20 per cent C steels containing 0.40 per cent P.[1] Those tests were made on hot-rolled material.

In the present series the authors found that 0.17 per cent P can be added to 0.5 per cent and 1.0 per cent Cr steels and still retain toughness after annealing as measured by the Charpy test. Five pairs of steels were made for the present study containing approximately 0.5, 1.0, 2.25, 3.5, and 5.0 per cent Cr respectively. One of each pair had a low phosphorus content and the other had 0.17 per cent P. The base composition was 0.13 per cent C, 0.58 Mn, 0.01 per cent Si, and 0.04 S. The steels were tested in the normalized and annealed conditions. The two high-chromium steels were

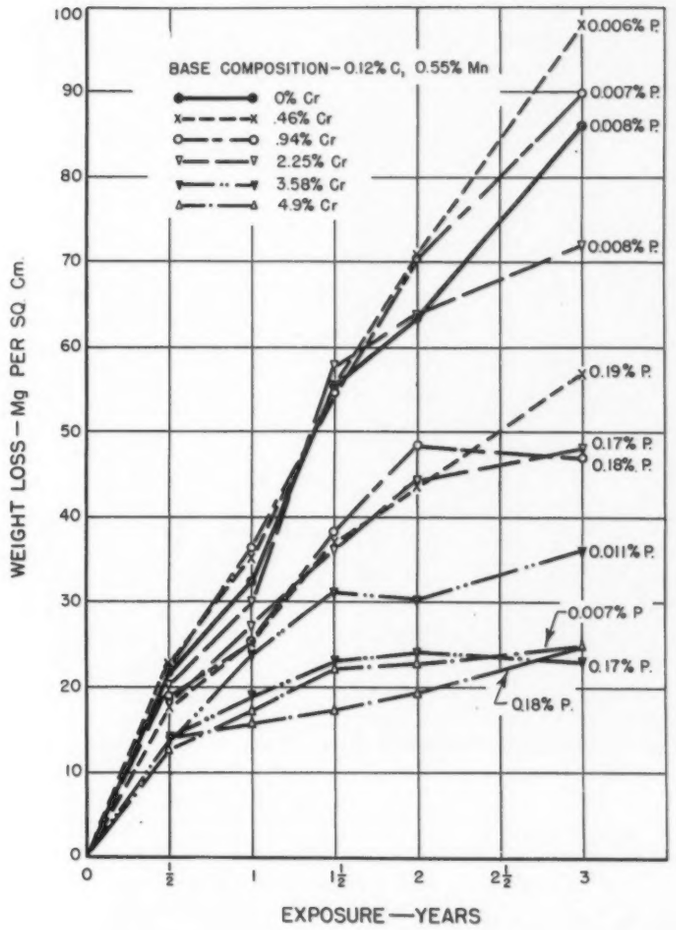

FIG. 4—Series I, low-carbon chromium steel containing phosphorus. These curves show atmospheric corrosion losses at various time intervals over a three-year period.

subsequently drawn for 4 hr. at 1250 deg. F. and air-cooled.

The static tensile properties of both sheets and bars were found to be satisfactory for both heat treatment conditions. In other words, with the carbon content used, the addition of 0.17 per cent P does not make the chromium steels brittle in the conditions tested. On the other hand, in dynamic tests these 0.17 per cent P steels having chromium contents above 2.25 per cent were notch brittle after annealing.

Present interest in the chromium steels centers about those with 0.5 and 1.0 per cent Cr and the test results, graphically shown in Fig. 4, indicate no improvement in resistance to atmospheric corrosion for those amounts of chromium in low-phosphorus steel. The addition of 0.17 per cent P to each one reduced the rate to approximately one-half. With 2.25 per cent Cr a decelerating corrosive effect of chromium was observed between the 2 and 3-year periods, though it was the 3.5 per cent Cr steel that was the first to show an improvement from chromium for all periods. The addition of phosphorus to this steel gave both a lower rate of corrosion at the start and a deceleration to practically nil from 18 months upwards. The 5.0 per cent Cr steel, with and without the phosphorus additions, showed about the same behavior as the 3.5 per cent Cr steel plus 0.17 per cent P. Over the first 6 months the attack was relatively fast, whereupon the rate diminished greatly, or to nearly nil, over the remaining periods.

Phosphorus shows up to advantage from the corrosion standpoint in high-chromium steels; however, before the high-phosphorus, high-chromium steels can be thought of as ready for engineering applications additional development work needs to be done on them.

TABLE I

Analyses of Steels for Series F

Steel No.	Composition, Per Cent				
	C	Mn	Si	P	Cu
F-1	0.15	0.45	0.10	0.008	0.35
F-2	0.14	0.45	0.10	0.172	0.35
F-3	0.15	0.45	0.10	0.007	1.17
F-4	0.12	0.45	0.10	0.17	1.17

Series J (Fe-P-Ni)

Two pairs of steels were made in this series. One contained 0.56 per cent Ni and the other 3.6 per cent Ni. One of each was low in phosphorus and the other contained 0.18 per cent. The base composition was 0.13 per cent C, 0.55 per cent Mn, 0.10 per cent Si, and 0.04 per cent S. The static tensile properties of all steels were generally satisfactory in both bar and sheet form and in both normalized and annealed conditions. The addition of phosphorus to the 3.6 per cent Ni steel lowered the per cent of elongation in 2 in. of the 22-gage sheet from 25 to 18 per cent and had as the main compensation an increase in tensile strength of about 15,000 lb. per sq. in.

Very little effect was found in the atmospheric corrosion tests from the addition of 0.56 per cent Ni, though it added slightly to the corrosion resistance of the low and high-phosphorus steels. The 3.6 per cent of nickel was found to be about as effective in mild steel as was reported previously for 0.17 per cent P, while the addition of 0.18 per cent P to this steel resulted in an additional improvement after the 3-year period corresponding to about 27 per cent.

Series K (Fe-P-Mo)

Two pairs of steels were made for this series, one with 0.24 per cent Mo and the other with 0.51 per cent Mo. The first of each of the pairs was low in phosphorus and the second contained 0.18 per cent P. The base composition

(CONCLUDED ON PAGE 88)

CLASSIFYING

By G. E. GORDON and E. A. REID

Metallurgical Department, Bethlehem Steel Co.

SPARK testing is a rapid method for identifying a number of the elements found in the various types of steels, and for evaluating the approximate quantities in which these elements are present. As the name implies, the testing is done by observation of the sparks produced as a rapidly revolving abrasive wheel is pressed against the steel to be examined.

The small particles of metal thrown off by the abrasive action of the wheel are oxidized and heated to incandescence as they are hurled through the air, thus producing what are commonly termed sparks. The color, shape, and size of the sparks are greatly affected by the type and the quantity of the chemical elements contained in a steel being tested. A trained observer is therefore able to learn much about the composition of a steel by close observation of the stream of sparks. Most important, however, is that all decarburization be removed before attempting to estimate the carbon content of a steel.

Spark testing has been used extensively by Bethlehem Steel Co. during the past 14 years. A regular staff of carefully trained spark testers is maintained in all of the company's plants. These men acquire a suprisingly high degree of skill in detecting the different elements and in estimating the amounts present. One of their duties is to check a steel during processing and before it is shipped, to insure against mix-ups of different grades. Another important function is to segregate the scrap used in the melting furnaces to prevent contamination of heats by elements not desired in the particular type of steel produced. Spark testing may also be used as a quick, rough test for the determination of excessive decarburization of steel bars.

Equipment Used

The spark testing equipment used at Bethlehem plants is portable and very simple. It consists of an abrasive wheel directly attached to the shaft of a ¼ hp. electric motor operating at 3400 r.p.m. The entire unit, complete with plug and extension cord weighs only about 14 lb.

Many different wheels were tried before the type now used was selected as the most suitable. This is a so-called safety wheel, made of aluminum oxide with a vitrified bond. The grit size is 0.3816 and the hardness rating P. The wheel has a diameter of 6 in. and a ½ in. hole at the center. It is 13/16 in. thick at the center, tapering to ½ in. at the periphery, and is supported on both sides by a 3 in. tapered steel flange. Both the speed and the size of the wheel must be kept constant as they have a decided influence upon the size and the number of sparks produced.

An important feature of the procedure is that no elaborate sampling or other preparatory work is required. The revolving wheel is applied to the steel to be tested, whether it be in the form of ingot, billet, bar, forging, pipe, or scrap, and the results are obtained immediately.

Spark testing is an art rather than a science and very little literature has been published on the subject.* Many of the expressions used have been coined locally and are the only terms available for explaining and describing the phenomena involved. The meaning of these terms is illustrated in the accompanying drawing. (See Fig. 1.)

The basic principle of spark testing is that with the content of other elements (except iron) remaining approximately constant the amount of sparks produced increases with the carbon content. Presence of other elements, in varying amounts, produces definite effects on the spark which will be described in the following paragraphs.

When the revolving wheel is pressed against a piece of steel containing about 0.10 per cent carbon, a stream of yellow shafts flies from the wheel.

*See other articles on spark testing in the Sept. 26 and Oct. 3 issues, 1935, THE IRON AGE.—Ed.

STEELS BY

SPARK TESTING

A few forks, about ⅜ in. long, branch out from the shafts. (See Fig. 2.)

As the carbon content increases, the forks begin to send out small sprigs, which, in turn, emit auxiliary forks with secondary sprigs. When the carbon content reaches about 0.30 per cent, small white hot spheres may be observed before the spark breaks. At this carbon range each spark would fill a circle of approximately 1¼ in. diameter. (See Fig. 3.)

With further increase in the carbon content the forks and sprigs take on a feathery appearance, with small, flowery tassels attached. This becomes more and more noticeable until the carbon content reaches about 0.75 per cent. At this point each spark covers a circle of about 2½ in. diameter.

On increasing the carbon content beyond 0.75 per cent the trend is reversed; the sparks become smaller in size and appear closer together. At 1.40 per cent carbon the stream has become a dense mass of sparks, each about the size of a dime. (See Fig. 4.)

Manganese, in the amounts usually found in steel, cannot be identified by the spark test. However, with 1 per cent manganese present, the spark becomes white, and fine white dashes, about 1/16 in. long, may be seen in the stream close to the point of contact between wheel and sample. As the manganese content is increased to about 14 per cent, the stream becomes thinner and the sparks are reduced to about a fourth of their normal size. Single shafts with buds bursting at the ends break at right angles to each other.

Sulphur may be detected when the content is above 0.2 per cent. The most marked change does not occur in the sparks themselves, but in the appendages which accompany them. The usual orange colored arrows become red and their length is increased by about one half.

Phosphorus, like sulphur, may also be detected in amounts above 0.20 per cent. The sparks are less bright, the sprigs or forks appear to have lost their feathery effect, and the whole stream takes on a "choked" appearance.

Silicon Easily Detected

Of all the elements commonly found in steel, silicon is the most easily detected. The shape of the spark is changed by a variation of 0.15 per cent in this element. When the silicon con-

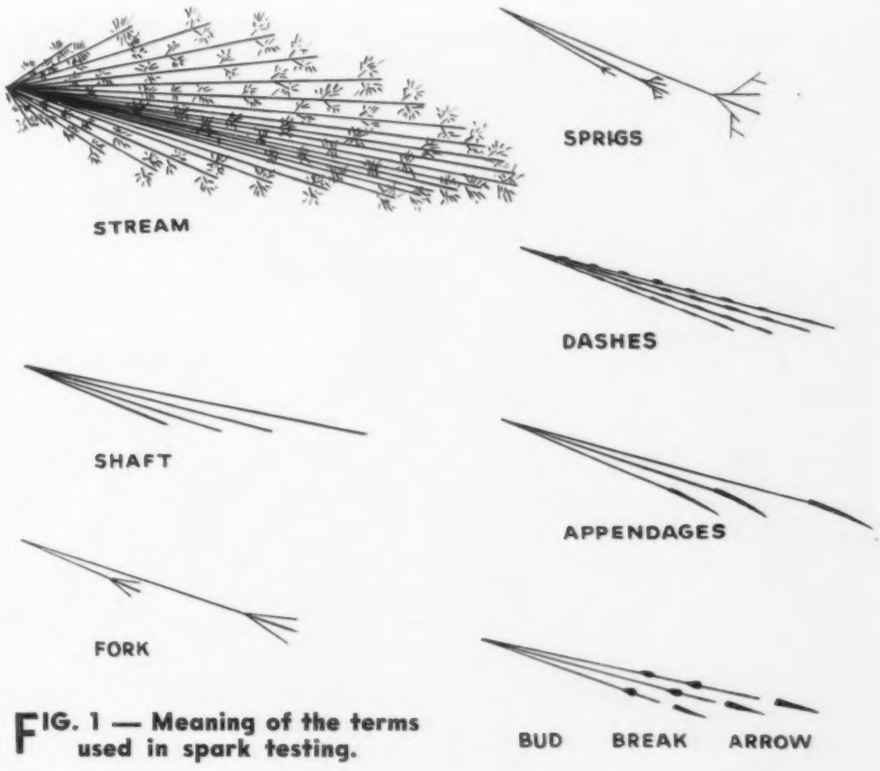

FIG. 1 — Meaning of the terms used in spark testing.

FIG. 2—A few forks appear in the spark stream from a low carbon steel, such as shown here for a 0.14 per cent carbon steel.

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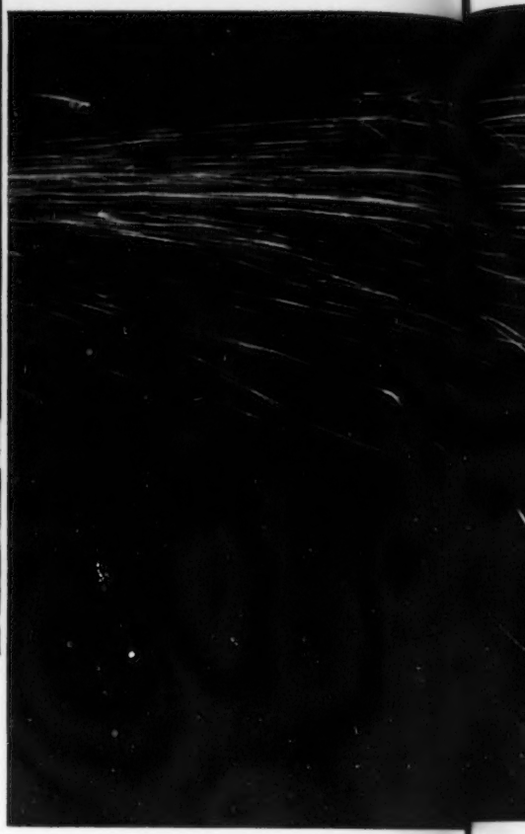

FIG. 3—When the carbon content spheres that appear before the the one shown here at extreme the forks and sprigs take on a larger, up until 0.75 per

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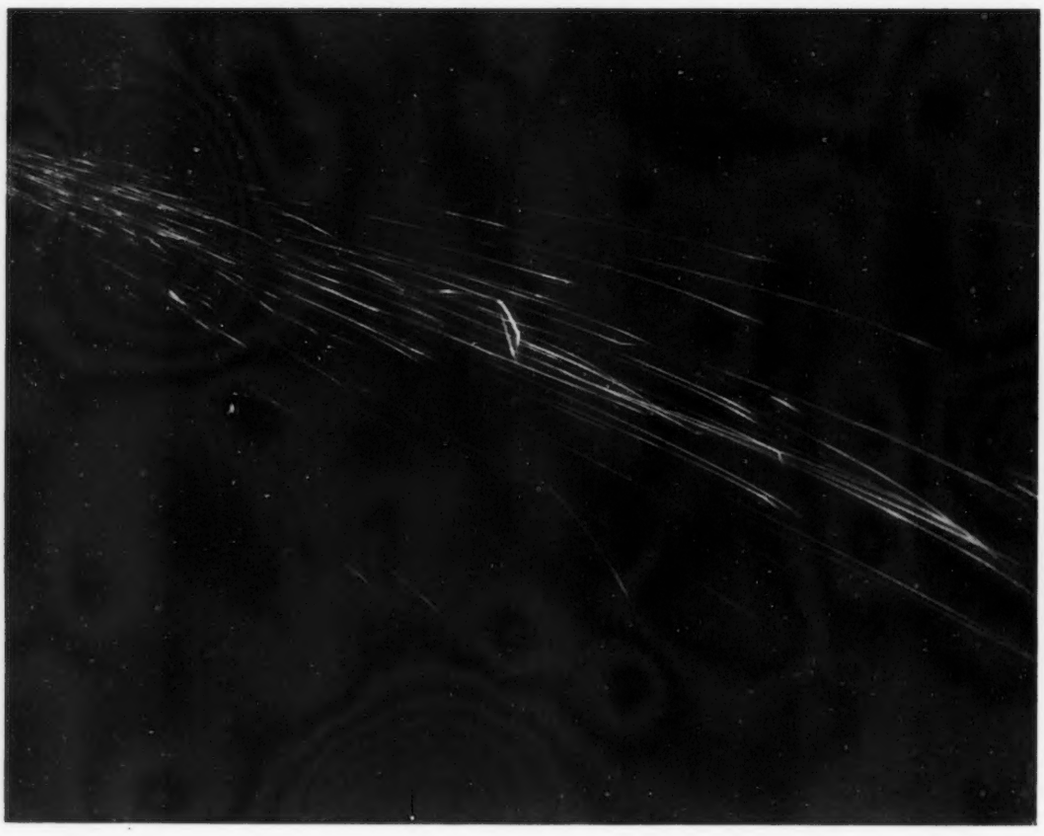

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FIG. 5—Silicon is the most easily detected alloy. Note the small white spheres in the spark stream at left, and scattering characteristic of streams; also, forks that appear to swell before bursting. Budded ends of forks can also be discerned at left.

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reaches 0.30 per cent, small white spark breaks are typical, such as right. With increasing carbon feathery appearance and become cent carbon is reached.

FIG. 4—Above 0.75 per cent carbon the sparks become smaller in size and appear close together. This view shows sparks from 1.30 per cent carbon file steel.

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FIG. 6 — When molybdenum is present a small orange colored arrow appears at the end of each shaft. Note characteristic arrows at shaft ends. Forking is caused by 0.42 per cent carbon in this chromium - aluminum - molybdenum steel.

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tent reaches 2 per cent, as in silico-manganese spring steel, the change is very marked. The stream is scattered and contains small white spheres which appear to swell before they burst into shafts about ¾ in. long, having branching forks with budded ends. The appendages of the stream of sparks always describe a short, orange colored arc. (See Fig. 5.)

The presence of nickel in a steel is indicated by pale blue dashes about ⅛ in. long, which appear close to the wheel and follow the trajectory of the shafts throughout the stream. Testing for nickel by the spark method is rarely done in Bethlehem plants, however, as the so-called spot test (see details of this test at end of article) gives more definite results and is quick and simple.

Chromium is one of the most difficult elements to detect by the spark test method. *The characteristic spark produced by an electric furnace chromium steel is different from that of an open-hearth chromium steel of the identical analysis.* The former gives a spark of a deep golden color, characterized by short forks and sprigs with fine, flowery ends, while the open-hearth steel gives a white spark. The forks are longer than they would be with no chromium present. A difference of 0.30 per cent chromium may be detected by a skilled spark tester.

Molybdenum, on the other hand, is easily detected. When this element is present, a small orange colored arrow appears at the end of each shaft, separated from the shaft by a gap of about ¼ in. (See Fig. 6.) If nickel is present with the molybdenum, the color of the arrows is red rather than orange.

Tungsten has a very marked damping effect on the spark stream. If 0.5 per cent tungsten is present in a steel containing 0.5 per cent carbon, the stream shows only a few flowery sparks, instead of a large number of sparks as would appear in a straight 0.5 per cent carbon steel. With 1 per cent tungsten, or more, only a few short, red shafts appear in the spark stream.

No definite spark characteristic has been observed which may be used for the detection of vanadium in the small amounts found in commercial steels (rarely above 0.2 per cent). Comparing the sparks for two specimens which are approximately of the same analysis, except for the vanadium content, a slight difference in appearance may be observed. However, this difference is so slight that it defies description.

Additions of small amounts of aluminum to a steel cannot be detected by spark testing. However, if appreciable amounts are added to a steel containing chromium and molybdenum, the appearance of the spark is altered. The sparks become white with only a few single breaks, their number is decreased, and the stream becomes shorter and thinner.

This description of spark testing admittedly does little more than scratch the surface insofar as the portrayal of the manner of identification and the quantitative approximation of the composition of a steel is concerned. It does, however, give some indication of the principles upon which a spark tester bases his work. Many hours of practical experience and close observation by a competent operator must be combined with the knowledge of these principles before accurate spark testing can be accomplished.

Spot Test for Nickel

The spot test is based upon the fact that in a solution which is alkaline with ammonium hydroxide, nickel will react with dimethyl glyoxime to form a precipitate of nickel dimethyl glyoxime which has a bright red color.

The spot tester's equipment consists of a portable box containing a bottle of a dilute solution of nitric and phosphoric acids, a supply of small strips of white blotting paper and a bottle containing a solution of dimethyl glyoxime, ammonium hydroxide, glacial acetic acid and ammonium acetate.

These solutions are made up in the following proportions:

Acid Solution

800 cc. nitric acid.
1000 cc. water.
200 cc. phosphoric acid.

Dimethyl Glyoxime Solution

25 gm. dimethyl glyoxime.
750 cc. ammonium hydroxide.
300 cc. water.
1200 cc. glacial acetic acid.
250 gm. ammonium acetate.

In routine spot testing, a drop of the acid solution is placed on the clean spot of the steel left by the action of the abrasive wheel of the spark test. The acid is left on the bar for approximately 10 sec. in order to allow the acid to react with the steel. The drop of acid is then absorbed on a strip of white blotting paper and a drop or two of the dimethyl glyoxime solution is applied to the spot of saturated blotting paper. The ammonium hydroxide in the latter solution neutralizes the acid used to dissolve the steel and, if nickel is present, the saturated spot on the blotting paper turns bright red due to the precipitation of nickel dimethyl glyoxime by the reaction of the nickel salt with dimethyl glyoxime in the presence of an excess of ammonium hydroxide. If no nickel is present, the blotting paper turns a light straw color.

The purpose of the acetic acid and ammonium acetate in the dimethyl glyoxime solution is to serve as a buffer to prevent the precipitation of the hydroxides of elements in the steel other than nickel, which if allowed to form, would cover up the red color of the nickel dimethyl glyoxime.

The presence of nickel in steel in amounts under approximately 0.30 per cent will not be detected in the spot testing procedure as just outlined. The characteristic red color begins to appear in the test as the nickel content is raised above 0.30 per cent, becoming increasingly brighter with increasing amounts of nickel.

An experienced spot tester can approximate the amount of nickel present in steel within about 0.50 to 1.00 per cent, depending on the analysis of the steel, by observing the intensity of color of the red spot. With practice, the spot test can be carried out very rapidly when used in conjunction with the spark test.

There are a few precautions which must be taken in spot testing in order to obtain authentic results. The spot on the steel where the test is taken must be absolutely clean. The presence of oil on this spot will give a red color on the blotting paper even though no nickel is present. Also the drop of acid placed on the spot must not run off the spot onto the scale on the bar.

If the steel being tested is too warm, a variation in results will occur since more steel, and thus more nickel, will be dissolved by the acid in the 10-sec. interval of contact of acid and steel than would be the case at lower temperature. If the bars are extremely cold, erratic results may be obtained because the action of the acid is retarded.

The spot test is of course not applicable to stainless steels which are not readily attacked by nitric acid.

In some cases, the spot test has been carried out by applying the dimethyl glyoxime solution directly to the drop of acid on the steel rather than to the saturated blotting paper. If nickel is present in such a case, the liquid on the steel will turn red. However, when this method is used, it is impossible to approximate the steel's nickel content and part of the efficiency of the test is lost.

Flame Hardening of CAST IRON

By FRED G. SEFING
Development and Research Division, The International Nickel Co., Inc.

WHAT types of cast iron can be used for lathe bed ways which will flame harden to high hardness (550 Brinell) with little distortion? What is the depth of hardness? The author herein reports on extensive experiments along this line to determine the effect of nickel or nickel and chromium or alloy additions to the iron, an effective stress relieving technique, and an adequate flame hardening procedure.

FLAME hardening is a portable heat treating process in the sense that the heat is carried to the work instead of the work being carried into the heat, as is true of quenching and tempering heat treatments. Castings such as cam tips, gear teeth, lathe bed ways, valve seats, etc., which are subject to wearing action over a localized portion of their surface can be heat treated by flame hardening to improve the wear resistance of the working surfaces and thus extend their useful life.

In general, flame hardening is carried out on heavy castings thick in section or complicated in shape and unsuited for heating in usual heat treating furnaces. Thus, the localized hardening by flame heating becomes both practical and economical.

P. A. Abe[1] has shown how flame hardening has been successfully applied to lathe bed ways. He explains the advantages of using the proper alloy and carbon and silicon composition to achieve the desired results.

Since alloy cast irons respond promptly and positively to hardening heat treatments, it becomes important and economical in the final accounting to employ the alloy irons where flame hardening is practiced to be assured of a positive hardening effect. Important incidental properties require that the surfaces that are hardened produce the least distortion in the castings along with the toughest possible hardened layer.

The technical principles of hardening cast iron by *flame hardening* in one case or heating above the critical temperature and quenching by the ordinary methods in the other are the same.

The time intervals in flame heating are exceedingly short and those irons which are more susceptible to the ordinary hardening treatment will likewise respond very much better to the flame hardening treatment.

From the hardening characteristics of plain and alloy cast irons shown in Fig. 1[2], it will be seen that the lower silicon or lower total carbon irons respond best and that lowering the total carbon is more effective than lowering the silicon. The same general relationship of the hardenability of nickel with chromium, or molybdenum, accentuates the response. The differences in results obtained between flame hardening and conventional hardening by quenching are due to: (1) The tremendous differences in heating time between the two methods; (2) the large temperature gradients before quenching in the case of flame hardening compared with the uniform temperatures in the case of conventional quenching methods.

The choice of an alloyed cast iron composition for flame hardening may materially be influenced by the selection of a desirable balance of physical properties, such as machineability, fine grain, toughness, strength, rigidity, etc., which are included in the main body or core of the casting.

Hardenability test results[3] on Ni-Mo and Ni-Cr-Mo irons shown in Fig. 2 demonstrate considerably greater hardness penetrations for these irons as compared with the unalloyed iron. Since in flame hardening, the flame has a limited time in which to act, it would be expected that cast irons containing a small amount of the transformation retarding alloys, would harden with greater certainty. Furthermore, alloys which lower the critical ranges should assist in producing a greater depth of penetration for a given temperature, because the temperature gradient from flame temperature at the surface to critical temperature below the surface would spread over a greater depth.

It is also evident that the lower the temperature to which the piece is heated, the less will be the distortion upon quenching. Since nickel (Fig. 3) and manganese lower the critical temperature range, while silicon (Fig. 4) and other elements raise it, obviously the optimum cast iron compositions would contain as much of the "critical temperature lowering" elements as practicable with others reduced to essen-

[1] "Flame Hardened Lathe Beds," by P. A. Abe, Metal Progress, July, 1939.

[2] "American Progress in the Use of Alloys in Cast Iron," Foundry Trade Journal, Vol. 49, 1933.

[3] "Hardening and Tempering Gray Iron," by Timmons, Crosby and Herzig, A.F.A. Transactions, 1939.

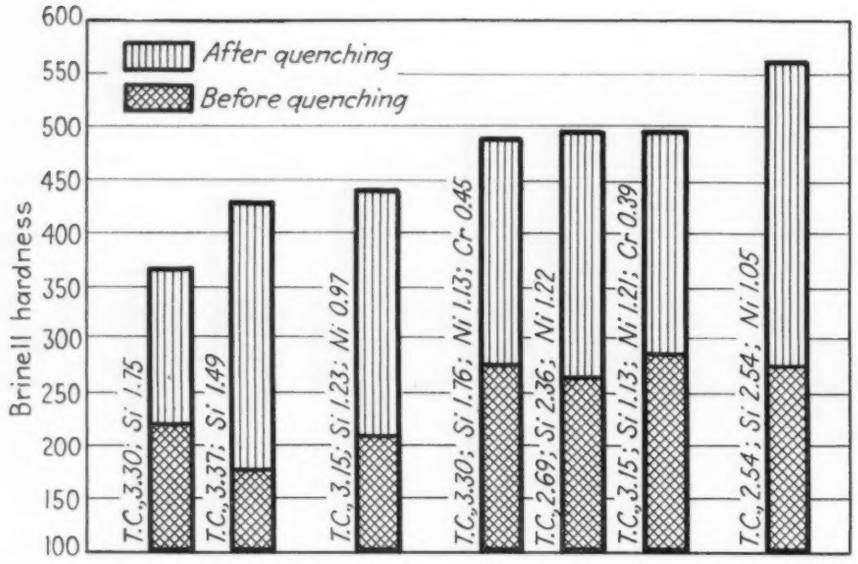


FIG. 1—Hardness of plain and alloy cast iron, 1¼-in. arbitration bars, before (lower division) and after quenching in oil from 50 F. deg. above the critical range.

tial or necessary amounts. These considerations would indicate a general specification for good flame hardening cast iron of T.C., 3.3 per cent max.; Si, 1.0 min. to 2.0 max.; Mn, 0.60 min. to 1.0 max.; Ni, 1.0 min. to 2.0 max.; and 0.75 max. of Cr-Mo-V.

A further refinement in the limits of this specification could be applied as the elements are adjusted to minimum casting thickness and fitted where needed to develop important properties, such as machineability, toughness, strength, etc.

To explore this specification an investigation was made upon some cast irons to observe the effect of different carbon, silicon and alloy contents of cast irons and their response to the flame hardening heat treatment.

Flame hardening applied to gray cast iron of different compositions can produce a hardness of 70 to 80 Shore, or 70 to 80 R_A which corresponds by actual test to 40 to 50 R_C, or about 500 to 575 Brinell. These hardnesses can be made to vary from a thin surface film to a maximum penetration of about 5/16 in. when using the progressive method of flame hardening.

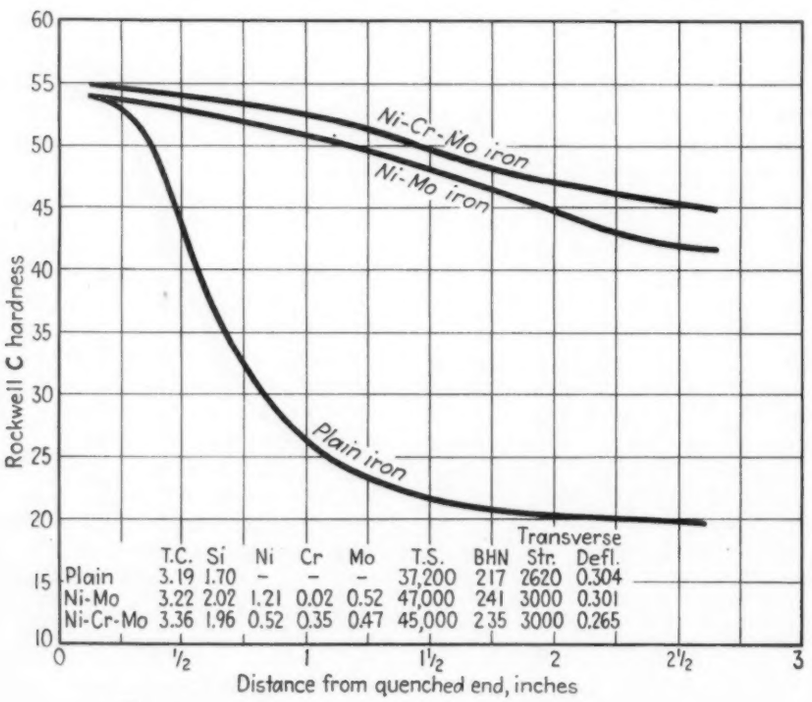


FIG. 2—Hardenability tests for plain and alloyed cast iron.

In present commercial applications of the progressive method of flame hardening, the depth of the hardened layer is generally controlled by using a constant intensity of the oxy-acetylene flame and varying the speed of the flame travel. Under these conditions the slower the speed the more heat is developed at the skin and the greater the penetration. A depth beyond 5/16 in. with present commercial practice results in the temperature of the surface becoming so great as to burn or melt the surface. In a particular iron the higher the surface temperature the deeper the hardened layer and the greater the hardening stresses would be. These stresses when sufficiently high tend to produce distortion of the flame hardened part.

Therefore, in order to restrain the

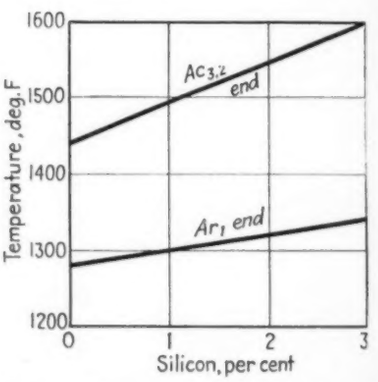


FIG. 3—Critical ranges of plain cast iron containing 3.3 per cent total carbon.

hardening stresses from distorting the machine part, the minimum depth of penetration to suit the requirements and the minimum heat to produce this penetration should be employed. The work of this paper shows that a nickel or nickel-chromium iron will develop a particular depth of hardened layer with less heat than will an un-alloyed iron accompanied, of course, with less of the hardening stresses.

Three different compositions were investigated both as plain and alloyed cast irons: First (3.25 T.C., 1.75 Si): second (3.25 T.C., 1.20 Si); and third (3.0 T.C., 1.75 Si). Of these three base compositions it will be seen that the 3.0 T.C., 1.75 Si irons were most responsive to the flame hardening treatment. Lowering the total carbon (3.25 to 3.0) offsets the higher silicon (1.20 to 1.75). Furthermore, the addition of nickel or nickel and chromium to gray cast iron improves the flame hardening characteristics. The com-

plete composition of the irons investigated are given in Table I.

Test Procedure

Test blocks, 3x3⅝x12 in. to correspond to the thick sections of heavy castings commonly flame hardened, were cast horizontally with the 3⅝-in. faces on the top and bottom. The 3⅝-in. faces of the castings were machined by removing ⅜ in. of metal and finishing each face flat, as is customary in commercial practice. The machined castings were tested for hardness, which data are given in Table I.

The intensity of the flame tips and the character of the flames were those commercially used in flame hardening.

The gas flow of both the acetylene and the oxygen was measured by calibrated meters. The water flow through

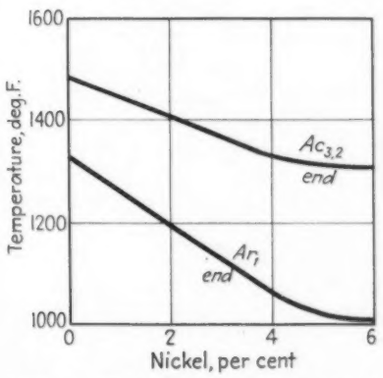


FIG. 4—Effect of nickel on the critical ranges of cast iron containing 3.3 per cent total carbon and 1.3 per cent silicon.

the head on to the heated block was delivered at from 105 oz. to 99 oz. per min. during the 3 to 4-min. run. Blocks were immersed in water up to within ⅝ in. of the surface, corresponding to commercial practice. The flame hardening procedure data is given in Table II.

The flatness of each test block before and after hardening was measured by means of a spherometer whose spheroidal segment was 11 in. in diameter. These values are given in Table III and are in inches in 11 in.

Hardness surveys were made on each test block after hardening by taking 18 readings each when using the Shore and R_A hardness testers and 9 readings when using the R_C tester. The minimum, maximum and average hardness readings are shown graphically in Fig. 5.

The R_A readings were more reliable than the Shore readings because the

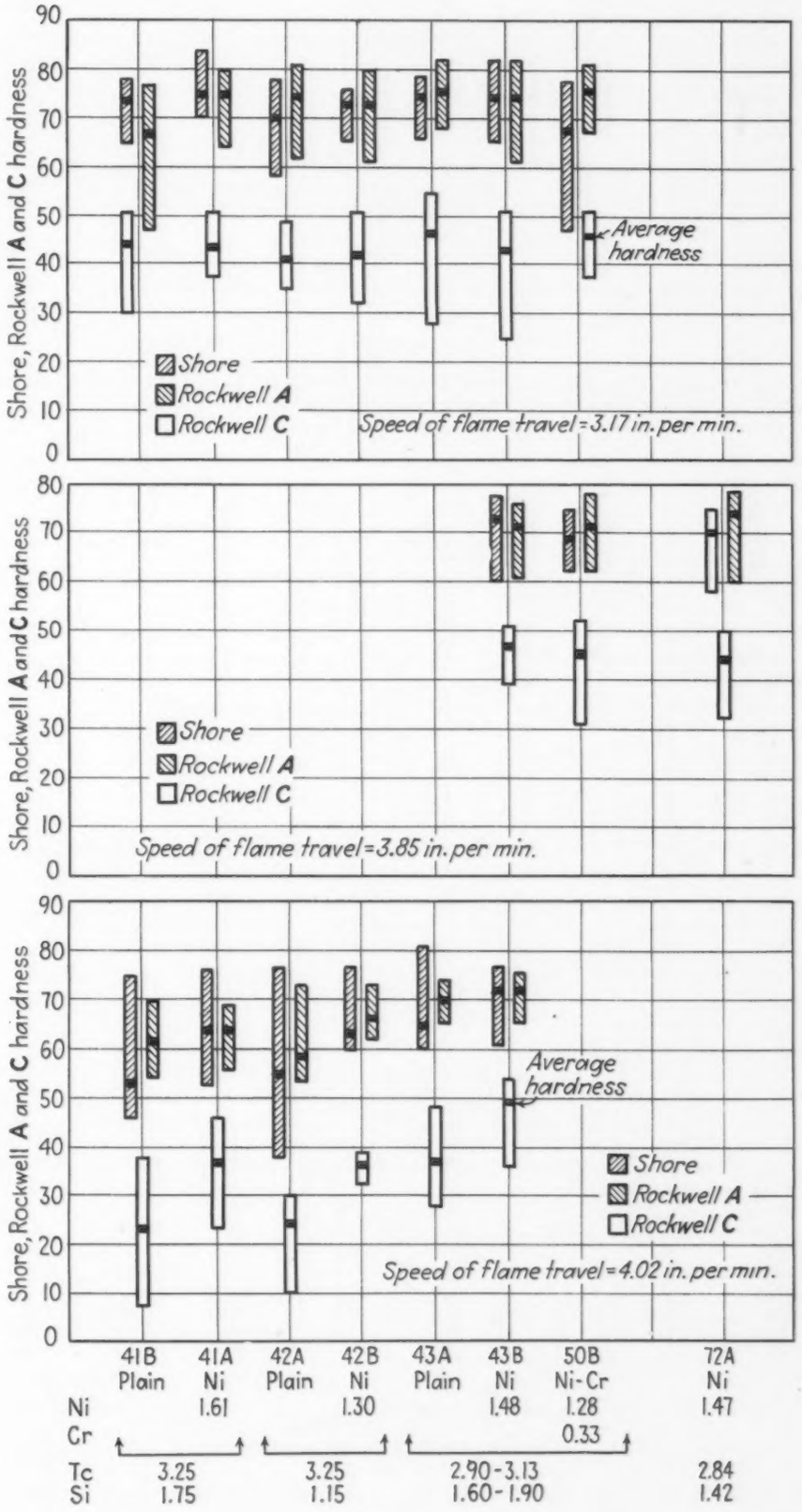


FIG. 5—Surface hardness range of flame-hardened cast iron.

TABLE I

Iron Compositions and Hardness, as Cast

No.	T.C.	Si	Mn	Ni	Cr	Mo	Hardness BHN*	Hardness RA
41B	3.27	1.80	0.65	...	...	...	170	50
41A	3.22	1.76	0.67	1.61	...	...	179	54
42A	3.32	1.13	0.52	...	...	...	179	54
42B	3.24	1.19	0.57	1.50	...	...	164	55
43A	2.92	1.64	0.96	...	...	...	207	59
43B	3.13	1.84	0.86	1.43	...	...	205	56
50B	2.95	1.67	0.81	1.28	0.33	...	240	59
72	2.84	1.42	0.91	1.47	...	...	...	57
76	2.99	1.87	1.07	1.52	...	...	...	55

* Center of drag face of blocks

TABLE II

Flame Hardening Procedure

Series No.	Flame Travel Speed, In Per Min.	Acetylene Gas Flow, Cu. Ft. Per Min.	Oxygen Flow, Cu. Ft. Per Min.	Flow Water
A	4.02	200	210	not measured
B	3.85	209	219	99 to 105 oz. per min.
C	3.17	209	217	99 to 105 oz. per min.

Flame head 3 in. wide set ½ in. from test block which was submerged in water to within ⅝ in. of the surface to be hardened.
Each test began at the unmarked end of test block after flame was permitted to play for 30 sec. before moving at indicated speed.

TABLE III

Distortion of Plain and Alloy Irons

Number	Type of Iron	Series	Speed of Flame Travel, In. Per Min.	Depth[1] of Hardened Layer, In.	Distortion,[2] In.
43AI	Plain	A	3.17	0.15	+ 0.0030
43BI	Ni	A	3.17	0.17	+ 0.0035
50B	Ni-Cr	A	3.17	0.17	+ 0.0015
72A	Ni	B	3.85	0.15	+ 0.0010
76S	Ni	B	3.85	0.13	+ 0.0010
50B3	Ni-Cr	B	3.85	0.12	+ 0.0015
43A	Plain	C	4.02	0.07	— 0.001
43B	Ni	C	4.02	0.13	± 0.000

[1] Depth and width determined by measuring cross-section after etching with nital. [2] Distortion measured with spherometer of 11-in. diameter spheroidal segment. + Indicates convex. — Indicates concave.

TABLE IV

Effect of Stress Relief Anneal at 300 Deg. F. for 7 Hr.

No.	Type	Thickness*	Hardness (Rockwell A) Hardened	Stress Annealed	Bow of Test Pieces, Hardened	Stress Annealed	Per Cent Relieved
41BI	Plain	....	66.7	70.3	....	....	..
41AI	Ni	....	74.7	70.0	....	....	..
42AI	Plain	0.510	74.7	70.8	0.037	0.022	41
42BI	Ni	....	72.5	68.5	....	....	..
43AI	Plain	0.520	76.0	71.8	0.044	0.028	36
43BI	Ni	....	74.2	70.7	....	....	..
50B	Ni-Cr	0.518	75.2	75.5	0.040	0.030	25
50B3	Ni-Cr	0.495	71.0	...	0.041	0.029	29
72A	Ni	0.517	74.0	...	0.041	0.037	9
76S	Ni	0.495	71.0	...	0.037	0.026	30

* Strips 10 in. long by ¾ in. wide by the depth indicated were cut from half the hardened block.

method of test of the Rockwell is less dependent upon the operator and in the case of tapered surfaces, accuracy with the Shore test is difficult. The R_C readings were not generally true surface hardness values because of the penetrator tending to puncture through the hard layer causing unreliable hardness values.

Each block, after flame hardening, was sectioned longitudinally through the center and transversely 2 in. from one end. These sections were polished and etched to develop the depth of the heat affected surface which was measured to an accuracy of 0.01 in. Fig. 6 (left) shows that the depth of the heat-affected layer across the direction of flame travel is very uniform, except at the outer edge and this can be taken care of by using proper width of tip. Although the width of the flame head was 3 in., the heat effect on the 3⅝ in. wide test blocks was greatest in the center, tapering off somewhat toward the edges of the flame heat. To develop the maximum depth of the hardened layer along the edges, it is necessary to employ proper technique because of the tendency of these edges to melt down in the intense heat of the flame. For the same reason, the hardened layer at the beginning and end of the test block was not as deep as a short distance from these ends—see Fig. 6 (opposite). These edge effects of flame hardening must be given consideration when a hardened layer of uniform thickness is desired.

The hardened skin was explored by taking a tapered cut through a 4-in. long piece from the center of one of the longitudinal halves illustrated in Fig. 6 (above). This piece was machined to a slope of 0.08 in. per 1 in. on the hardened surface, then ground to a smooth finish. The depth of hardness penetration was measured by the R_A on the beveled blocks, a typical illustration of which is given in Fig. 7. The line of deepest penetration of minimum hardness of 70 R_A, as illustrated, shows the contour of depth of full hardness penetration as revealed in the beveled hard surface. This value was selected as it corresponds generally to the minimum hardness of a fully hardened cast iron, about 500 Brinell. The data for depth of hardness are shown graphically in Fig. 8 for flame travel speeds of 4.02, 3.85 and 3.17 in. per min. Although the depths of the hard layer were measured only on one side of the block, the charts show these depths on both sides, as they were assumed to be approximately the same.

In Fig. 5, it may be seen that the hardness values increased when the flame travel speed was decreased from 4.02 to 3.85 in. per min. but changed little or none between 3.85 and 3.17 in. per min., which indicates that when an average hardness of 70 to 75 R_A was attained no further increase in hardness resulted even though the amount of heat input was increased. However, from Fig. 8 it may be seen that the depth of the hardened layer increased as the speed of flame travel decreased, which is to say that the depth of

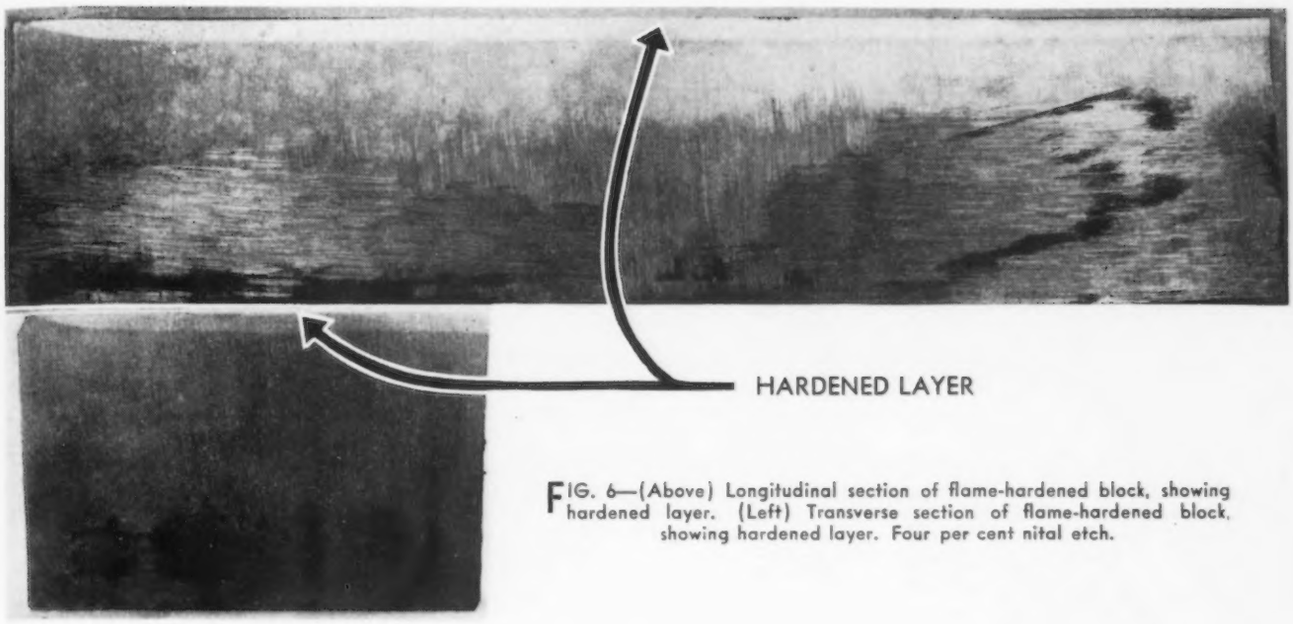


FIG. 6—(Above) Longitudinal section of flame-hardened block, showing hardened layer. (Left) Transverse section of flame-hardened block, showing hardened layer. Four per cent nital etch.

hardness increased as the amount of heat put into the surface increased. Apparently flame hardening produces about the same degree of hardness but widely different depths of penetration on different composition irons. The effect of the flame hardening treatment on cast irons, therefore, may be measured best by the depth of the hardened layer and not by the degree of hardness produced on the surface.

The greater susceptibility of a particular composition iron to hardening, the deeper the surface hardness will penetrate and the wider the hardened layer will be.

From the hardness penetration curves, Fig. 8, it is apparent that nickel, and nickel-chromium alloy additions to gray iron increase the penetration. These alloy irons will develop a particular depth of hardened layer with less heat than will an unalloyed iron, resulting in less of the hardening stresses. (See Figs. 9 and 10.) It is also apparent, by comparing the unalloyed irons in Fig. 8, that the lower the carbon or silicon the greater the depth of hardness. This, of course, conforms generally to the hardenability of various cast irons shown in Fig. 1.

Distortion and Stress Relief

From Table III it may be seen that the distortion of a particular iron increases generally as the depth of the hardened layer increases. The distortion per 0.1 in. of penetration was generally less for the alloyed irons than for the plain irons.

Distortion resulting from flame hardening is caused by: (1) The increase in volume when the cast iron is transformed by heat treatment to the hard constituent martensite (see Fig. 11); (2) the stresses set up by the very rapid heating and cooling during the flame hardening treatment. Of course, there is nothing that can be done about the increase in volume due to the change from pearlite (Fig. 11) to martensite. However, the stresses of the flame hardening treatment can be materially reduced by employing basically tough irons in the low critical hardening temperature ranges and the lowest surface temperature under the flame to produce the required depth of the hard layer. For ex-

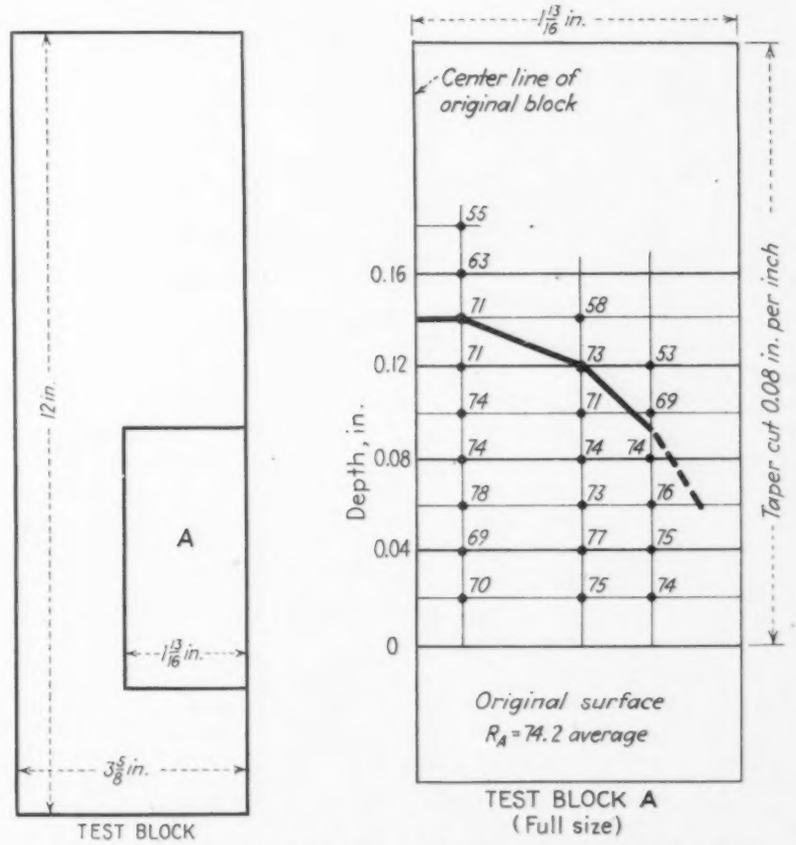


FIG. 7—Method used to determine the depth of the fully hardened layer. R_A hardness.

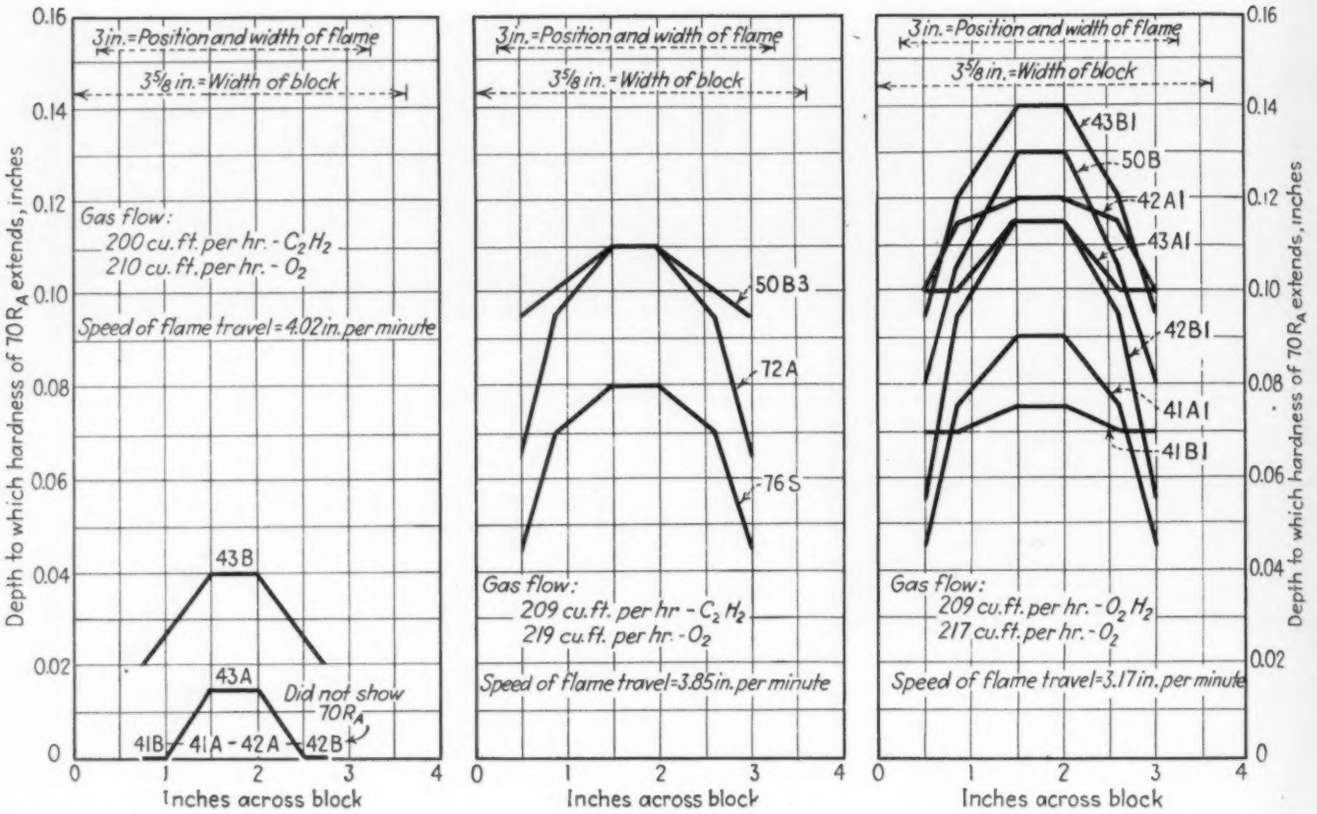
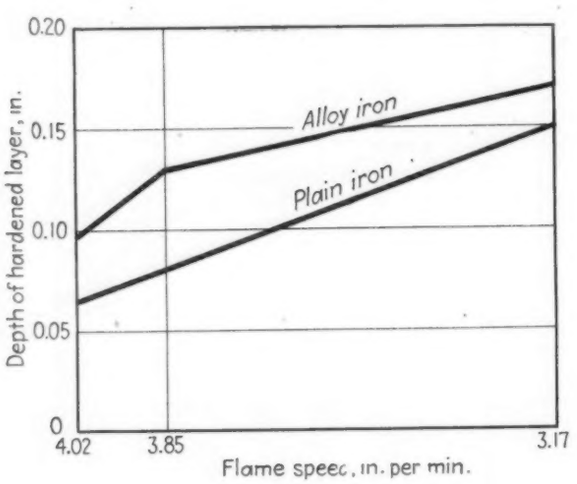

3 in. = Position and width of flame
3 5/8 in. = Width of block
Gas flow:
200 cu. ft. per hr. - C2H2
210 cu. ft. per hr. - O2
Speed of flame travel = 4.02 in. per minute
43B
43A
Did not show 70RA
41B
41A
42A
42B
3 in. = Position and width of flame
3 5/8 in. = Width of block
50B3
72A
76S
Gas flow:
209 cu. ft. per hr - C2H2
219 cu. ft. per hr. - O2
Speed of flame travel = 3.85 in. per minute
3 in. = Position and width of flame
3 5/8 in. = Width of block
43B1
50B
42A1
43A1
42B1
41A1
41B1
Gas flow:
209 cu. ft. per hr. - O2H2
217 cu. ft. per hr. - O2
Speed of flame travel = 3.17 in. per minute
Depth to which hardness of 70RA extends, inches
Inches across block

FIG. 8—Hardness penetration of various plain and alloyed cast irons.

	T.C.	Si	Ni	
41B1	3.25	1.75		
41A1	3.25	1.75	1.61	
42A1	3.25	1.15		
42B1	3.25	1.15	1.50	
43A1	3.00	1.75		
43B1	3.00	1.75	1.43	
76S	3.00	1.75	1.52	
50B	3.00	1.75	1.28	0.33Cr
72A	2.84	1.42	1.47	

ample, by studying Fig. 9 it is obvious that those alloy irons with deep hardness penetration would require considerably less heat under the flame than a plain iron to achieve a hard layer depth of say 0.14 in. Then, it may be stated that those irons which show the greatest penetration will require the least heat to develop a particular depth of the surface hardness and therefore will suffer the least distortion.

It was evident that a large number of tests would have to be made to get a reliable measure of the distortion. However, a trend of the effect of flame speeds and alloy composition

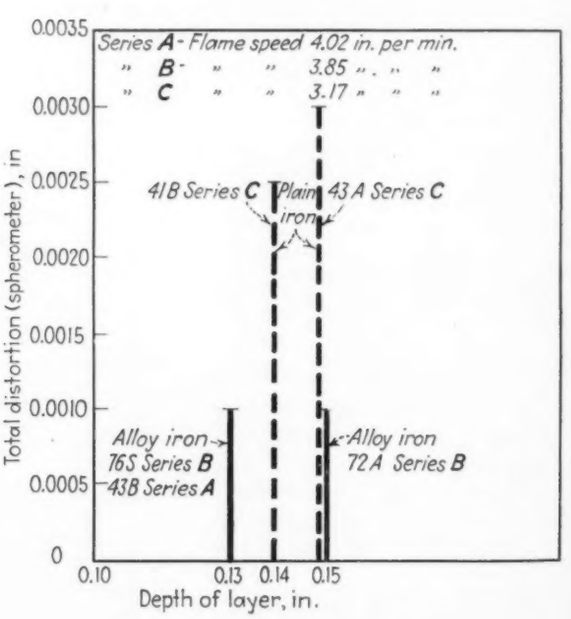


ABOVE

FIG. 9—As shown, nickel alloy irons produce greater depth of hard layer than plain irons at same flame speed.

AT RIGHT

FIG. 10—Nickel alloy irons produce the same depth of hardness with less heat and less distortion than plain irons. As in Fig. 8, left to right, Series A = flame speed of 4.02 in. per min., Series B = flame speed of 3.85 in. per min., and Series C = flame speed of 3.17 in. per min.


Series A - Flame speed 4.02 in. per min.
" B - " " 3.85 " " "
" C " " 3.17 " " "
41B Series C
Plain iron
43A Series C
Alloy iron
76S Series B
43B Series A
Alloy iron
72A Series B
Total distortion (spherometer), in
Depth of layer, in.

was indicated by the values obtained from the plain and alloy irons of the 3.0 per cent total carbon, 1.75 per cent silicon irons which are given in Table III and which indicate the following trends: (1) The distortion increases with slower flame speeds; (2) for appreciably the same depth of hardness the alloy irons tend to show considerably less distortion than the plain irons. (See Fig. 10.)

The distortion which does result from the flame hardening treatment can be reduced by a stress relief anneal without lowering the hardness below 70 R_A.

In order to study the effects of stress-relief annealing, samples of several flame hardened castings were obtained from the half section similar to Fig. 6 (above) by cutting longitudinal strips 10 in. long by ¾ in. wide and about ½ in. thick including the center portion of the original hardened layer. Upon cutting these strips from the blocks considerable bow was produced which was caused by the stresses set up by the hardened layer.

By stress-relief annealing the above strips at 300 deg. F. for 7 hr., 25 to 40 per cent of the distortion stresses were removed with only 2 to 5 points decrease in the hardness (R_A) as shown in Table IV.

Microstructures

The photomicrographs in Fig. 11 show the structure of the hardened layer of the nickel iron test piece No. 8743B1 from the edge to the original untreated iron. The one view (B) illustrates the typical structure of the entire fully hard layer between the edge and the position of (C), which shows the structure of the iron that attained temperatures into the critical range. (D) in Fig. 11 shows the original structure. Indeed, (A) to (C) in Fig. 11 are typical structures of the flame hardened layer of the different composition irons investigated. Of course, the depth of the different zones from the hardened surface varied from one iron to another as indicated in Table III.

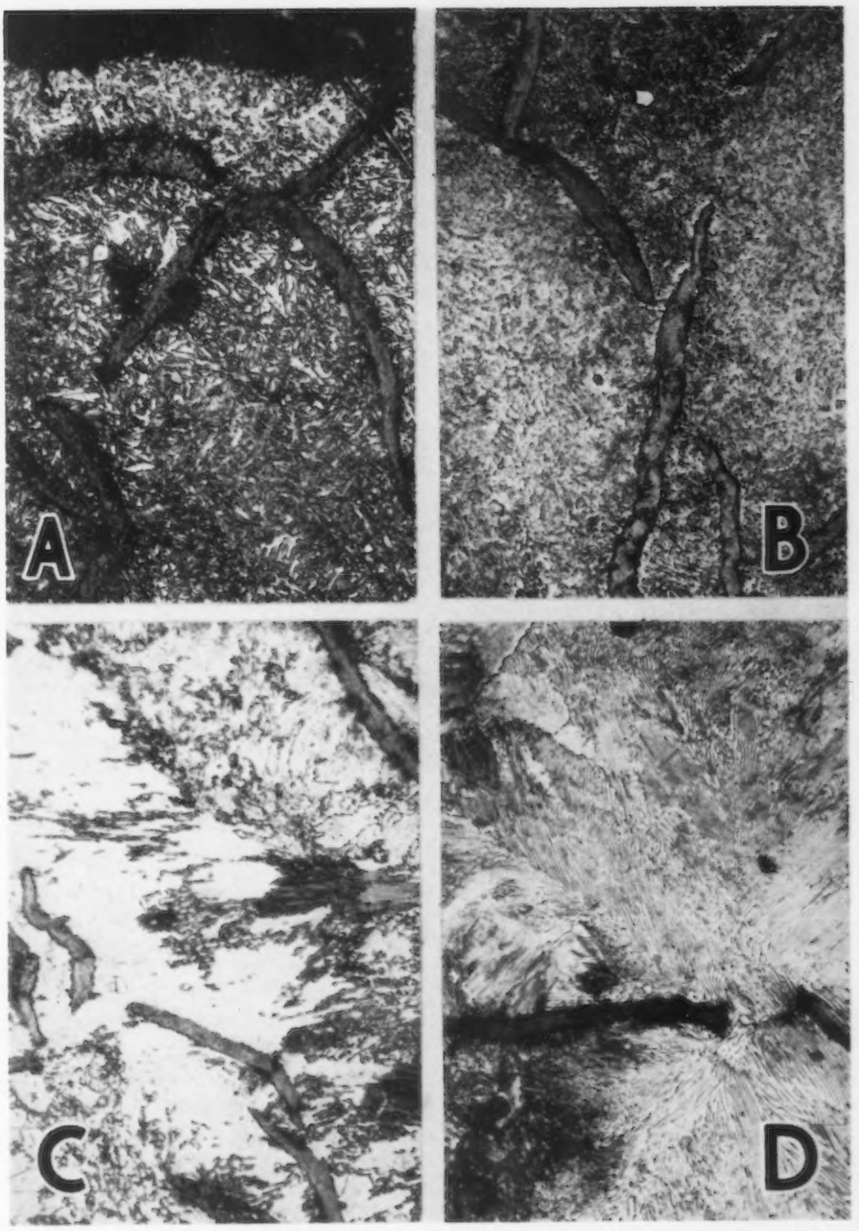


FIG. 11—Nickel iron No. 43B1, nital etch, at 500 diameters. (a) Edge of hard surface; (b) center of hardened layer (martensite); (c) transition zone heated into critical range; and, (d) original structure (pearlite).

Summary

(1) An average surface hardness of 70 to 75 Shore, or 70 to 75 R_A, or 40 to 50 R_C can be attained by flame hardening cast iron using the proper flame manipulation. From available conversions this is equivalent to 500 to 550 Brinell.

(2) The addition of nickel or nickel and chromium or molybdenum to cast iron improves its response to the flame hardening treatment so that less heat is required to produce a desired depth of the surface hardness.

The lower critical hardening temperature of nickel alloyed irons assists in:

(a) The production of a deeper hardness by the same heat input.

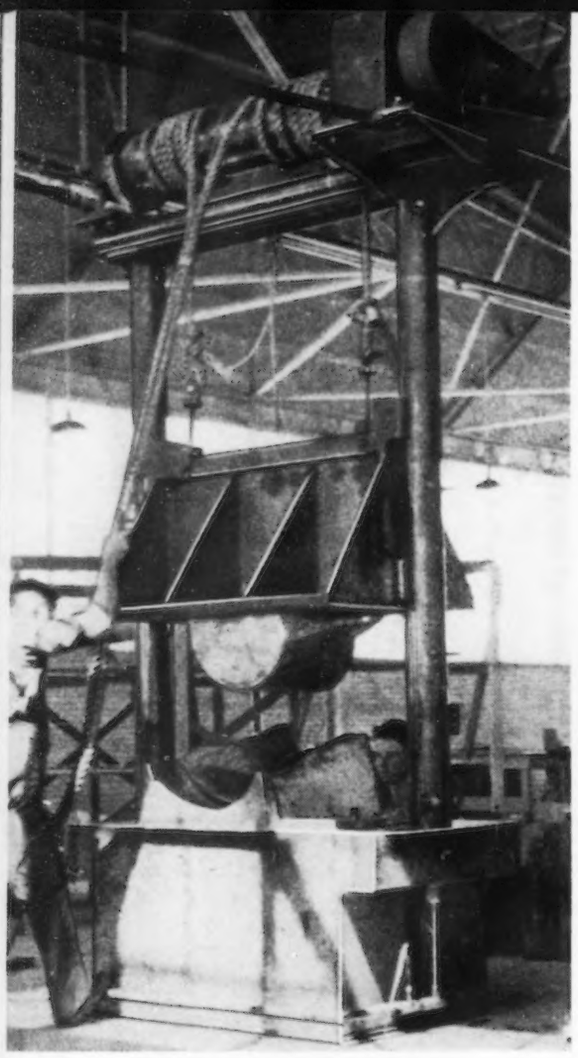
(b) Less distortion per unit of depth.

(3) The lower stresses resulting from flame hardening nickel alloyed cast irons compared with plain irons hardened to the same depth cause less distortion.

(4) The distortion stresses due to flame hardening increase with the depth of the hard layer in the same iron. Therefore, the hard layer should be kept at a minimum thickness for the type of service required.

(5) From 25 to 40 per cent of the stresses set up by flame hardening can be relieved by a stress relief anneal at 300 deg. F. with only a 2 to 5 point drop in the R_A hardness.

The author acknowledges the kind cooperation of John J. Crowe, manager of apparatus research, and Carl Saacke, research engineer, of the Air Reduction Sales Co. and the suggestions and advice so freely given by J. S. Vanick and Dr. J. T. Eash of the International Nickel Co.



USED for many years in the silver industry in stamping out spoons and the like, the rope drop hammer in recent years has found its way into the aircraft industry. The machine shown was built by Ryan Aeronautical Co. for its own use. This company through its general superintendent, Fred Rohr, was one of the pioneers in developing some of the newer techniques of drop stamping.

Job-Lot Aircraft

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By FRANK J. OLIVER
Associate Editor, The Iron Age

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UP until the very recent past an anomalous situation has existed in the aircraft industry in the United States. Scientific design principles and the use of research has been carried further than in any other field except perhaps that of electrical engineering. Through the correlation of mathematical formulas with wind tunnel tests on small scale and full scale models, it is possible to predict the performance of a new design—its power requirements, speed, rate of climb, etc.—before it is taken off the drawing board. Yet with all this design engineering progress, from a production point of view the aircraft industry is still in the stage that the automobile industry was about 20 to 25 years ago. Automotive engineering, conversely, is still a matter of empirical formulas and cut and try. Automotive production, on the other hand, spurred on by the possibilities of unit cost reduction inherent in special tooling on single purpose machinery, is tops.

Why aircraft production techniques have lagged—and here we refer specifically to fuselage and wing construction rather than engine manufacture, which is blood brother to automotive production—is probably due primarily to two factors—short runs due to the rate of design obsolescence, and the type of personnel that first entered the aircraft industry. Generally, the heads of these firms had started in the business as pilots or were pilot minded. The research angle was largely a matter of Government aid supplied through the great research laboratories of Langley Field and the Air Corps material division at Wright Field, besides work done by the Navy and the Department of Commerce. In all these government divisions, emphasis was placed on design factors rather than on methods of manufacture. The best at any cost seemed to be the goal. The colleges naturally placed the emphasis on design and stress analysis also.

This sort of policy was all right for the Government, but commercially it was not a success and the way was soon strewn with financial failures. New funds had to be sought from the outside, and in many instances it was these moneyed interests that forced the pilot-minded executives to hire real production engineers, many of them with experience in the automobile industry way back when production quantities were on a much more modest basis than now. The wiser aircraft manufacturers did the same thing without prompting.

Design Considerations

At this point it might be well to point out the chief design differences between planes made here and abroad, particularly in England. British bombers, for example, largely are being made with a basket weave frame construction, covered with a doped fabric. Here in the United States, all-metal construction is used for both military and transport ships. The British decision was made on the point that cloth-covered ships are not so readily damaged by a burst of shrapnel and may easily be repaired in the field. Conceivably a British pilot could repair a bullet hole with a handkerchief and a tube of glue. Replacing a panel of stainless steel or duralumin is a different matter and one not entrusted to amateurs. In a less military minded country, the all-metal ship has advantages in durability that outweigh this consideration. It should be noted, however, that the military ships currently on contract for the British and French governments are all-metal types.

With one exception, the all-metal

STAMPINGS

ONE model a year suffices the automobile industry, but in aircraft design it is practically one model a month. In no other industry is technological advance so rapid, nor so much of a headache to the production executive. Not mass production, but job-lot production is his lot. To meet the challenge of high costs, the builders have had to resurrect old techniques, bring them up to date, even build their own equipment until some machinery builder sensed the market. In the first part of the article drop hammer methods are discussed, whereas the second part, to be published in next week's issue, largely describes work performed on hydraulic presses and stretching machines.

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design, now used on all except private executive and sport ships in this country, has a stressed skin; that is, the metal covering is a structural member, much as a web section of a girder, and to this extent shares with the framing part of the shear, compression and tension loads. In a cloth covered ship, although the covering must bear the lift loads the cloth obviously cannot carry compression loads, and the framing must be correspondingly heavier. In fact, the weight advantage is in favor of the all-metal plane in some specific designs.

This factor of a stressed skin at once places limitations on manufacturing techniques. From a design point of view, automobile fenders and bodies carry no loads and the material is selected not from the point of view of strength but for its deep drawing qualities—its ease in manufacture. Not so in the aircraft industry. Aluminum alloy, the most widely used material, was selected for its high strength-weight ratio and its ability to resist corrosion; stainless steel for practically the same reasons, although the absolute values are different. Strength with lightness means a relatively high tensile strength, resulting in a springy material difficult to form. This is particularly true of stainless steel, but both "dural" and stainless are temperamental metals. The fact that, far more than other metals and alloys, they tend to get back into their original shape unless stressed well beyond the elastic limit in forming and shaping has an important bearing on the selection of the processes by which these materials are fabricated.

In the light of automobile body practice and even present-day aircraft fuselage manufacture, some of the first attempts to make all-metal ships were ludicrous. Sheets the size of this page were put together with countless rivets—at 5¢ per rivet! The reason is not far to seek. It was difficult to find men acquainted with sheet metal work in small lots (the automobile industry with its mass producton was no help), and it was even more difficult to find machines suited to job-lot work. Originally, practically all sheet metal aircraft parts were hammered to shape by hand over sandbags or wooden forms. And it took all the skill of a skillful tinsmith, plus the skill of a good carpenter in making the forms. This method of manufacture obviously lent itself to small area pieces to avoid the necessity of producing shapes of double curvature. The difficulties were particularly great where compound shapes in ultimate form have little variation from a true plane.

It was at this point in the development that the industry turned to two types of machines that had long been in use—the rope drop stamp, a simple form of impacting tool that had been relegated to the manufacture of silverware, and was long out of production—and the hydraulic press, familiar to all but for which some long forgotten techniques had to be brought up to date to make the machine fit into the economic scheme of things from the point of view of low cost dies. It is important to emphasize at this point

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AT best the rope drop is a makeshift design, compared with modern production machinery. The air drop stamp is largely replacing it. This photo shows a Chambersburg Cecostamp in action and clearly indicates the low-cost, combination lead-zinc dies that establish the economic usefulness of this machine for job-lot work.

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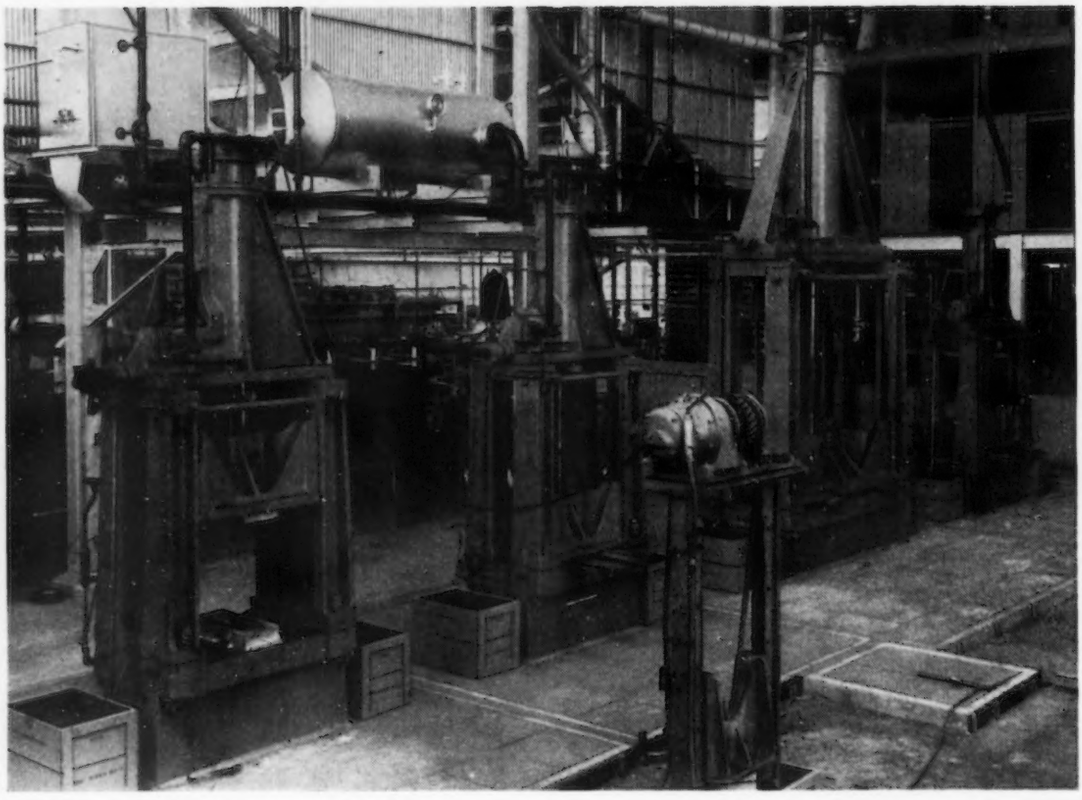

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ONE of the largest and most up-to-date installations of air drop stamps on the Pacific Coast is found in San Diego at the plant of Consolidated Aircraft Corp. The largest hammer has a capacity to handle a 12,000-lb. punch, with a hammer face of 4 x 8 ft., and is carried on an impact block weighing 440,000 lb. As is the case for all the hammers, the impact blocks are in turn mounted on special coil spring supports carried over steel piling driven to refusal. The small rope drop in the foreground is the company's own design and construction.

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that in aircraft fuselage production we are dealing with quantities of 100 or less due to frequent design changes and therefore the conventional blanking or drawing die-set is simply out of the question, except for certain small fastening pieces that run into high production.

The Rope Drop Hammer

The rope drop stamp looked like the answer and many were installed. They were all designed by the airplane manufacturers themselves and built in local job shops. As much as $5000 has been spent for machines of this type, and not so long ago. Many are still in use, particularly on the West Coast. This machine has several drawbacks, however. It lacks the ability to controllably squeeze the work into the female die before impacting it; it is relatively slow in operation, it requires hard effort on the part of the operator, and the frequent fatigue failure of the rope adds to the maintenance problem. In the last two years, pneumatically operated drop hammers have appeared on the market and have received wide acceptance. The air drop stamp gives the necessary control to avoid wrinkles in gathering and thickening metal, and the rates of production are three to 15 times that of rope hammer performance. Curtiss Aeroplane division of Curtiss-Wright Corp. has abandoned its rope drops

AT RIGHT

SECTION of a stainless steel exhaust manifold formed on an air drop hammer.

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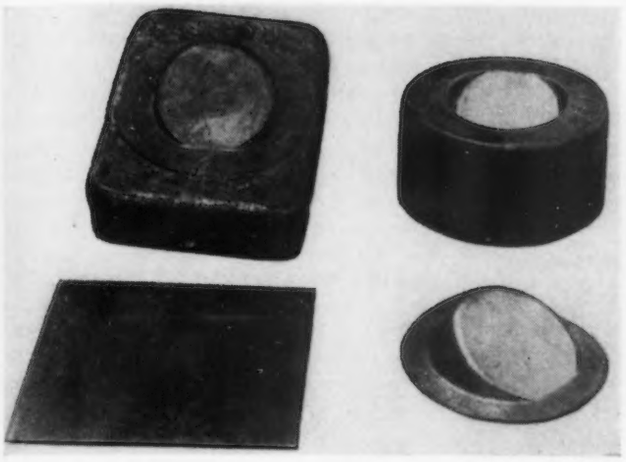
BELOW

SHEET metal pieces of double curvature are difficult to produce with the best press tooling available. This part took 6 min. to form on an air drop stamp, including time for hand manipulation between blows.



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LEAD punch and zinc die for a stainless steel cover stamping. The flange is 16 in. in diameter and the draw is 7 in. Including hand manipulation, the time for forming this piece was 7 min. on the Cecostamp.

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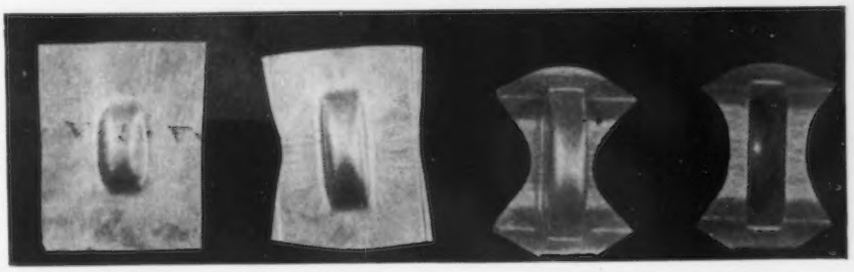
entirely and Glenn L. Martin Co., which has both types, is in the process of converting its last few rope drops to air drop stamps. By the time this article appears in print, the leading West Coast manufacturers will be replacing theirs to meet new demands upon their productive capacity. The technique employed will be detailed later.

What brought the hydraulic press forward in recent years was largely the result of work done by the Douglas Aircraft Co. in bringing up to date an old method of squeezing sheet metal over simple male or female dies with the aid of a thick rubber pad on the upper platen. The so-called Guerin process will be described in detail in the second part of this article. This technique is admirable for multiple blanking and for shallow right-angle draws or flanging with relatively small corner radii. It is also suitable for draws of medium depth when thinning out due to stretching of the metal on extreme contours does not represent a hazard to the safety and performance of a plane using a stressed skin. This limitation also applies to deep drawing operations on mechanical or hydraulic presses using conventional drawing dies and holddown rings, as well as to work done on stretching machines. For medium draws, the rope drop or the air drop hammer comes in. With the edges of the sheet unsupported, instead of thinning, a gathering of the metal occurs, resulting in thickening of the sheet at extreme contours. Actually, the process is one of cold forging and final shaping by impact.

The type of personnel available to the aircraft industry has had some bearing on the selection of machinery and processes. The location of the chief aircraft factories on the West Coast and at Baltimore (Buffalo is an exception) has meant that the companies have had to draw largely on unskilled labor. Many of the recently added workers are young boys just out of high school. In the instance of drop hammers, just as the mechanical part of the rope drop took up some of the skill of hand work over wood forms, so the air operated drop stamp takes up additional skill due to its ability to perform a sequence of carefully controlled operations. With a rope drop, to make 100 parts, it was often necessary to spoil six to 12 pieces before the proper sequence of blows could be established. The successful technique when arrived at could not be recorded properly thus causing costly loss of time and material on a duplicate run. With the air drop, on the other hand, this may be done, and there is the added advantage of much wider range of speed and impact power than with a simple gravity drop. In the case of the rope drop, the big factor is learning how to do the particular job over again and this wastes time and money.

With the hydraulic press or the stretching machine, practically all of the skill is transferred to the die and only the simplest manual labor need be performed by the operators. With the rubber pad method, die set-up becomes a task requiring no skill and little judgment other than a proper sense of space limitations.



EXAMPLE taken from Ryan Aeronautical Co. of a hand hold made in three stages on a drop hammer. The two pictures to the right are the inside and outside of the completed part. The flow of metal to form the deep draw can readily be seen. It is pulled in and compressed rather than thinned out.

Drop Hammer Technique

As the name implies, a rope drop hammer is a machine in which the hammer carrying the upper die is lifted by rope and allowed to drop by gravity, the amount of impact being determined by the height of lift. Five or six wraps of hemp rope are taken

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AN Alclad corner of a gasoline tank made in two steps in a drop hammer. The first stage part is deeper than the finished corner, and in the second stage the metal is pushed back to avoid thinning. Attempts to make this corner on a punch press die costing thousands of dollars were a failure. Ryan photo.

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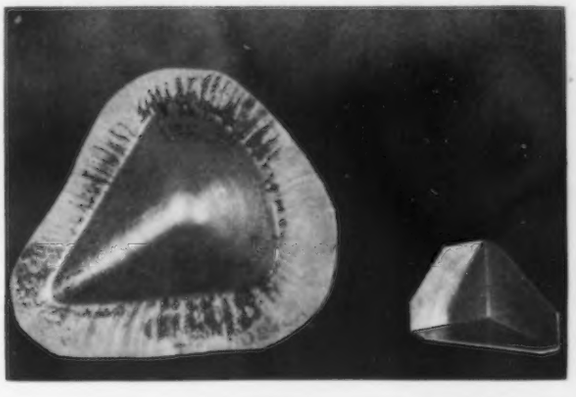

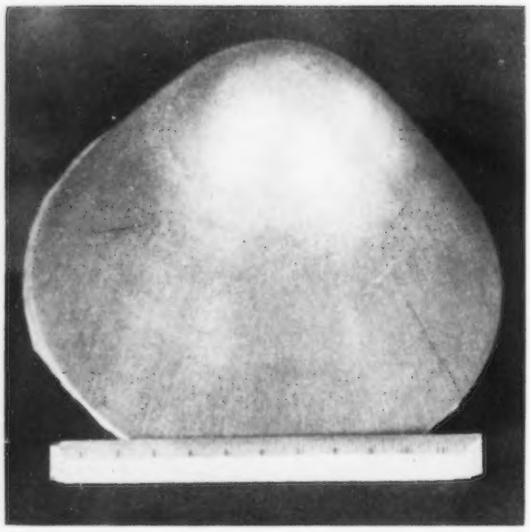

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RYAN nose spinner made of 24SO Alclad in seven stages on a drop hammer. The part formerly was spun from aluminum. On a drop hammer the part is rotated as it is lightly hammered.

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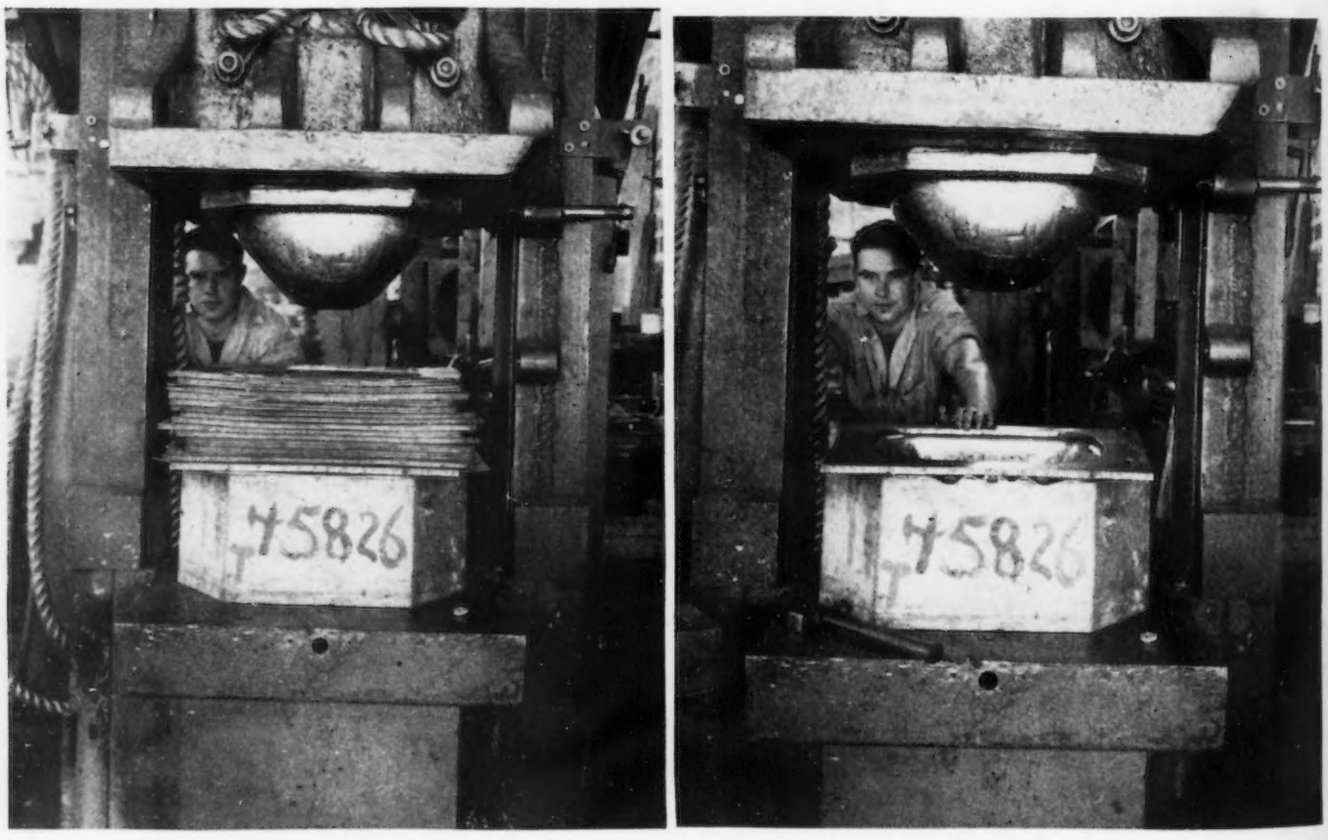
around a slowly revolving cast iron capstan drum and lift is effected by the operator putting his weight on the free end of the rope. When tension is released, the rope slips on the drum and the hammer drops. The rope is lubricated by a special grease to prevent undue wear or burning. Two ropes are generally used, either together at the middle of the hammer or one at each side. The rope usually breaks at the first turn on the drum, and to speed up replacement a long rope is sometimes used, with the unused portion wound up on a reel at the side of the hammer. The free portion is then simply looped between this reel and the capstan drum.

As has been mentioned, this cumbersome device has its limitations as to power of impact, speed of operation and delicacy of control. Two years ago, a steam hammer manufacturer saw the market possibilities of a machine driven by compressed air, and introduced the Cecostamp. Several other manufacturers have also brought air drop stamps since then with variations in design but operating on the same principle. In these machines, to the impact of gravity is added the much greater compressed air force. On the Chambersburg Cecostamp, manual control of the ram is available, or with the aid of a cam bar much like those used on steam hammers, automatic stroke operation can be had. The point at which the ram returns after each blow can be adjusted and the intensity of the blow can be limited. When manually operated, slow motion of the operating lever makes the ram move slowly and rapid motion makes the ram move quickly and hit a blow in proportion to speed of lever operation. Auto-



FORMING half of an oil tank at the Lockheed plant. The material is 3S0 aluminum, 0.064 in. thick. In performing a deep draw of this kind on a drop hammer, there are 14 draw rings used for the first blow, 13 of them $\frac{1}{2}$-in. wood rings and one boiler plate ring. At the right, all but the metal ring has been removed, one after each blow. The flange of the piece wrinkles and even folds, but there is no stretching of the metal.

matic operation is particularly helpful when moving long work progressively through the dies, such as when making corrugated flooring pieces. In general, the hammer blows are light at first, gradually becoming heavier until the final blows bottom. The average job requires three to five blows except on deep draw work.

Combination Lead—Zinc Dies

What has really made the drop hammer feasible for short run work in the aircraft industry has been the development of low cost lead-zinc dies. The master die is usually made from wood or from plaster supported on a wood skeleton. This master is then used as a pattern in casting the zinc female die in a green sand or dry sand mold. Some companies make their dies from dural, by melting down scrap. The die surface is quite smooth as cast and the only finish required is usually obtained by disk grinding with a portable electric tool or flexible shaft equipment. This zinc die then serves as the mold for the lead punch, which is poured directly into it after first forming a dam around the top. This procedure is practical obviously because of the difference in melting points of the two metals. The match of the two die halves is perfect, although sometimes disk grinding of the lead punch is required when thick stock is being worked. The lead tends to conform to the zinc shape as the die is used. About 4 to 12 per cent antimony is mixed with the lead, according to the hardness desired, the higher content giving the hardest die and generally longer life and better definition.

The most expensive part of the dies is the material cost, but in the long run this cost becomes negligible since the dies can be remelted when they have gone out of date.

In mounting the dies on the drop hammer, the punch is bolted to the hammer head first by means of studs cast into the back of the punch. Then the female die is positioned on the bed by the punch and is definitely located by pouring lead between the sides of the die and pins that are screwed at intervals into the press bed. Pieces of wood are clamped to the bed to act as a dam, or a flexible dam can be made from an asbestos tube filled with steel shot.

Drawn in Stages

Not all parts can be made with a single die set. Many parts involving deep draws and complicated corners are made in two to seven or more stages. This procedure is economically possible when it is considered that small die sets can be made for as little as $5, outside of the material, which is reclaimed.

Where the part is simple and symmetrical in form and the draw is deep, the work can be successfully performed with a single die in a drop hammer through the use of wood and metal draw rings. The sheet is first laid on the lower die and a steel draw ring, made of boiler plate, is laid on top of it, followed by from one to as many as 13 plywood rings, ¼ inch thick. After each stroke one of the rings is removed, and the final blow is direct on the die. The edges of the sheet wrinkle and even fold under the metal draw ring, since the constraining force is not large nor very well controlled, but this wrinkling is not objectionable unless the flange is to be kept and not trimmed. In that event, the piece has to be removed between stages and pounded out by hand occasionally. There is generally very little stretching of the metal, however.

Another method of doing deep draw work on drop hammers in stages is through the use of rubber. Three or four rubber slabs about 1 inch thick are piled over the sheet after it is laid on the lower die, then the slabs are removed one at a time after each stroke until the upper die finally bottoms on the sheet.

(To be concluded next week)

RUBBER is sometimes used to ease a sheet into a drop hammer die. This photo, taken at the Lockheed plant, shows an Inconel exhaust shroud, 0.043 in. thick, being made in stages with the aid of lots of rubber. At each blow, a slab of rubber is removed until finally the punch bottoms on the work itself.

Polishing Technique

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By WALTER M. MITCHELL
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THE polishing of the various stainless alloys, involving as it does a considerably different technique than for other metals, is described herein. In this, the first section of a two-part article, the author reviews the various types of stainless alloys, the range of commercial finishes, types of grits, preparation of wheels, and stresses proper sequence of grinding and polishing operations.

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PROBABLY no group of metals has come into as great popularity, or has found usage in as many diversified industries, in as short a period of time, as the group known as the stainless steels. Originally introduced in England, and later in the United States, as non-tarnishing steels for cutlery and tools, the original steels have now multiplied so that some 40 or more different compositions are now included within the limits of this group of alloys. Of these many analyses only a few are of interest to the fabricator, but the greatest tonnage produced is in these few compositions —hence, their importance.

Based on metallurgical characteristics and compositions, the stainless steels may roughly be divided into three types, as follows:

(1) *Martensitic Steels:* Usually produced with 12 to 14 per cent chromium maximum and sufficient carbon, even in sheet form, to be definitely hardenable by heat treatment. Owing to a comparatively rather low corrosion resistance, steels of this group are rarely used in sheet form for applications where a non-tarnishing material is required. These steels are magnetic, and are generally used for technical applications only.

(2) *Ferritic Steels:* Produced with higher chromium (usually 14 to 16 per cent minimum) and, if carbon is maintained low, are not hardenable by heat treatment. Corrosion resistance of this type is definitely superior to the previous type, and, in sheet form, these steels may be used for interior or protected applications where a non-tarnishing metal is desired. These steels are also magnetic. They possess good ductility and forming qualities.

(3) *Austenitic Steels:* These alloys are produced with high chromium and sufficient additional elements, usually nickel, to render them austenitic at all temperatures. In point of tonnage produced, and general utility, this group, which includes 18-8, is the most important, and the most frequently encountered in sheet form. These steels possess high ductility for forming and drawing operations, and the highest corrosion resistance of the whole group of stainless steels. They cannot be hardened by any process involving rapid cooling, but may be hardened materially by cold working. In the soft (annealed) condition austenitic steels are non-magnetic, but they will become slightly magnetic when hardened by cold work. Composition ranges will run from 17 per cent chromium, with chromium plus nickel 24 per cent minimum to higher ranges. Small percentages of other elements may be added, such as titanium, columbium, molybdenum, etc., to produce steels with special characteristics.

The usefulness of the stainless steels depends, in great measure, upon their unique property of maintaining brightly polished surfaces under conditions which rapidly tarnish and discolor other metals. Unless properly polished, where the nature of the product demands a high finish, the great advantage in the use of stainless steels is lost. The achievement of a proper polishing technique therefore becomes at once of major importance, especially when consideration is given to the fact that improper polishing methods are time consuming and hence costly.

Methods and abrasives ordinarily used for polishing nickel, brass, nickel-silver, and other metals, are generally unsuitable for stainless steels, and the development of a different polishing procedure is necessary.

Requirements for polished finishes are widely varied. In many instances it will be necessary to refinish areas where the original surface has been injured by die and tool marks, welding or other fabricating operations. Again, it will be necessary to refinish and polish articles that have been annealed and pickled—for such articles, especially hollowware and novelties, an attractive finish and appearance are highly desirable.

Surface finishes on flat-rolled products, as may be supplied by producing mills, may vary considerably, so that hard and fast rules of procedure that will apply in every case cannot be laid down. Variations from established procedure may be required depending upon the shape of the article to be polished. Serious consideration, therefore, should be given to the design of the piece at the outset so that all unnecessary projections, depressions, or other irregularities which might increase polishing costs are avoided. Experimentation may be necessary, and consultation with commercial suppliers of polishing and finishing materials is strongly advised. Instructions must, therefore, be generalized and confined to basic facts and essentials that will form the foundation of a satisfactory polishing technique.

STANDARD MILL FINISHES: Before proceeding to discuss polishing meth-

for STAINLESS STEELS

ods, it is desirable to describe briefly the different finishes in which sheets and strip are supplied commercially. As furnished by different producing mills such finishes may not be exactly identical although supposed to be generally standardized. Strip, which is narrow in width, can be rolled more satisfactorily than wider sheets in cold-reducing mills, and strip finishes are better in quality than cold rolled sheet finishes. Further, strip can be produced with greater accuracy in gage thickness than sheet, and this is important to the metal worker when considering forming and drawing operations.

Sheet and strip of the more popular compositions are furnished in the following commercial finishes:

SHEET FINISHES: No. 1 hot rolled, annealed and pickled—used "as is" for applications where surface appearance is of no importance, or where much forming and drawing, and subsequent annealing and pickling operations would destroy original polished mill finishes.

No. 2D. Full finish, dull cold rolled—a finish that is practically free from surface defects, and which, with proper care in forming and drawing, can satisfactorily be polished to a high luster in one or two operations. Material with this finish will have greatest ductility for forming.

No. 2B. Full finish, bright cold rolled—this is a somewhat smoother finish and has brighter luster than the preceding. While forming qualities are not as high, it may nevertheless be used for moderate stamping and forming operations that will require final polishing. Unless the surface is injured by tools or dies this surface can be given a very high luster with one or two buffing operations.

No. 4. Standard polished—this surface is produced by polishing with a succession of abrasives of different degrees of fineness, and is supplied when commercial "polished" stainless steel is specified.

No. 6. Standard polished, tampico brushed—a finish obtained by a final operation on the No. 4 finish with a rotating brush charged with fine abrasive. This is a soft, satin finish with low reflectivity, and is commonly used for architectural decorative work.

No. 7. High luster polish—a highly polished finish, more brilliant than No. 4, but not entirely free from polishing scratches.

No. 8. Mirror finish—the highest grade commercial finish. This finish should be brilliant, of high reflectivity and entirely free from all polishing lines and scratches.

The Nos. 4, 6, 7 and 8 finishes are furnished either one or both sides polished. They are suitable for such work as shallow draws, bending in a brake, etc., where the original finish will not be injured. The polished finishes are not economical where severe forming or deep drawing will be required as the annealing and pickling operations which follow will usually destroy such finishes.

STRIP FINISHES: Strip finishes are standardized, but not to the extent of sheet finishes. Strip is rarely furnished from stock, and is usually rolled to meet a given specification of width, gage and temper. Correspondingly, the finish is produced to meet the purchaser's requirements. Nevertheless strip finishes fall into types, which may be generalized as follows:

No. 1. Annealed and pickled—this is similar to the No. 1 finish in sheets, but in light gages will usually be smoother and higher in quality.

No. 2. Annealed and pickled and rerolled—this may vary from a smooth, dull finish similar to the No. 2D in sheets, to that corresponding to, and superior to, the No. 2B finish.

No. 3. Annealed, pickled and mechanically cleaned—this may vary from the No. 2, to a brilliant, smooth high luster that is almost mirror-like in quality, depending upon the equip-

ment and operating skill of the mill producing it.

Strip, in ground and polished finishes similar to those supplied on sheets, can usually be supplied in cut lengths to match standard sheet sizes.

Finishing Fabricated Articles

Polishing methods for stainless steels, as for other metals, will show many variations and the author does not wish to imply that the methods described in what follows are the only means of producing satisfactory finishes. While other abrasives and other polishing equipment may be used successfully, the author believes that the following instructions, if carefully followed, will bring satisfactory results and are such as can easily be carried out by the novice.

Obviously, the simplest procedure is to secure a supply of powdered emery or pumice, a piece of old rag, a little water, and go to work using plenty of "elbow grease." While the material cost will be low, the labor cost will be high, and the results not necessarily satisfactory. Far more satisfactory are the following instructions, which apply to the production of high quality finishes on articles made of austenitic, martensitic or ferritic stainless alloys. In practice, however, slight variations in procedure may be necessary because of the different characteristics of the various types.

It should be noted at the outset that it is most important that the metal be handled carefully in all operations that *precede* finishing. Careless treatment, whether by heat, pickling solutions, excessive deformation, or other abuse, will result only in increased cost of finishing operations. Consequently, the exercise of proper care and precaution in this respect will amply repay for itself in the final accounting.

The kind of abrasive to be used, and the method of its use will depend on the nature of the job. Where sharp cutting is required, as grinding down welding beads, removing pits, or other imperfections, from the surfaces of sheets, plates, bars, or forgings, solid abrasive wheels will give best service. Where higher finishes are required, as on sheets and strip, or on various formed articles that may be stamped or deep drawn, fabric wheels, the circumferences of which are charged with abrasives of proper degrees of fineness, should be used.

In all cases, grinding or polishing of stainless steels must be done with more than usual care. The thermal conductivity of all stainless steels is low. Moreover they have high frictional qualities, and overheating and "burning" are far more likely to occur than with other metals. The former will cause severe distortion with austenitic steels, where the coefficient of thermal expansion is large, and burning will impair corrosion resistance of all grades.

Martensitic and ferritic steels are sometimes difficult to polish satisfactorily because of their well-known tendency to drag and score. The surface of the polishing wheel tends to load up and produce objectionable scratches, so that additional time may be required to produce a satisfactory finish, and the wheels need frequent dressing.

The high coefficient of expansion of the austenitic steels will cause buckling and distortion when these are overheated. If this occurs, the work must be allowed to cool before continuing operations, otherwise a light gage area may result or a depression be formed, which will be conspicuous in flat surfaces due to reflecting differently from the surrounding surface.

The higher alloy stainless steels, 21 per cent and 27 per cent chromium, 25-12 chromium-nickel, etc., are used chiefly in heat and oxidation-resisting applications, or for equipment for chemical industries, and polished surfaces will seldom be required.

It is well to emphasize that in the surface finishing of stainless steels, or in fact any metals, short cuts are not possible. Failure to appreciate this at the outset will result in unsatisfactory finishes, as well as much waste of time and money. Each successive operation must be carried through to completion, and intermediate steps cannot be omitted. Low costs in surface finishing, therefore, do not result from short cuts, but from a proper sequence of operations, and the selection of best quality abrasives for each operation.

The words "grinding" and "polishing" are frequently used synonymously with resulting confusion. For the purpose of these instructions, *grinding* will refer to operations with *solid abrasive wheels* for removal of surface defects, as pits, seams, slivers, die and tool marks, and for reduction or complete removal of welding beads. *Polishing* will refer to operations with *fabric, leather, or other wheels*, the surfaces of which are charged with fine abrasives, either "dry" or with lubricant, for production of fine finishes. *Buffing* is for production of highest possible, or mirror, finishes, free from all scratches. This operation logically follows polishing. Buffing is done with soft built-up fabric wheels of various types, called "buffs," revolving at high speeds and using the finest abrasives with lubricant.

All abrasives used on stainless steels, no matter what the operations, *must be iron free*, otherwise discoloration and rusting from iron contamination will likely follow. Cleanliness is essential. Stainless steels are very subject to contamination from other metals. *Wheels used for stainless steels should in no case be used on other metals.*

Throughout all operation of grinding, polishing, or buffing, it is definitely desirable to change the direction of cutting from one operation to the next. This will greatly facilitate removal of cuts and scratches which, if the same direction were continued, would otherwise be cut deeper and deeper. By changing direction, visual inspection will at once show whether the scratches from the previous operation have been entirely removed. In some cases, however, it may be impossible to change direction because of the nature of the job, and here better results are secured if the wheel is moved back and forth sideways to prevent the cutting of long grit lines.

For grinding, and the coarser "dry" polishing operations, manufactured abrasive of the fused aluminum-oxide type is recommended. This is marketed under various trade names as, Alundum, Aloxite, Lionite, Vanite, Adamite, Aluminox, Hytens, Borolon, etc. The artificial abrasive has the advantage of great hardness and cutting power; also, the grains fracture when dull so that new, sharp, cutting edges are continually presented.

For producing higher finishes, Turkish emery (imported) is strongly recommended. The edges of the grains wear dull and smooth without fracturing, and thus tend to have a burnishing action.

Abrasives are available in standard sizes of grain, or "grit number," which run as follows:

Coarse: 12, 14, 16, 20, 24.
Medium: 30, 36, 46, 60.
Fine: 70, 80, 90, 100, 120.
Very fine: 150, 180, 220, 240.

Flour sizes: 280, 320, 400, 500, 600.

In these, the grit number corresponds to the number of meshes per linear inch of the screen used in sizing the grains.

Only those abrasives that are closely screened for uniformity in size should be considered. The presence of only a few grains of coarser grit will cause

scratches that will require much effort to remove. The same applies to carelessness in allowing grits to become mixed or contaminated. Each grit number should be kept separate in covered containers, and all articles, including the operator's hands, thoroughly cleansed from abrasive before beginning the next operation.

Surface finishing operations will comprise two steps, as follows:

(1) Removal by grinding, or otherwise, of all die marks, imperfections, as seams, pits, slivers, etc., including welding beads, to obtain a clean uniform surface or "base" on which the desired finish may be built up.

(2) Polishing the "base" with various abrasives in suitable grit numbers until the desired finish is obtained. This usually resolves itself into either of two problems—matching the original finish by keeping color and scratches the same, or altering the entire surface to meet a particular requirement.

Grinding

For this operation, as defined above, *solid* abrasive wheels are used. Experience has shown that for stainless steels the organically bonded (rubber, bakelite, etc.) wheels have greatest cutting action and, hence, are more efficient than the vitrified wheels.

When welding beads must be removed—as is frequently necessary, whether merely for improved appearance, to provide sanitary surfaces for equipment for handling food products, or for other reasons—the procedure will have been determined, in large measure, by the skill of the welder who did the job. That is, whether a smooth or rough surface was produced on the bead.

If the weld surface is rough and uneven a solid wheel with grit No. 16 to 36 will be required—the rougher the bead the coarser the grit number. The diameter and face of the wheel depend somewhat on the nature of the work. It is easier to control the direction of grinding if the wheel is small. Grinding should be done along the bead, and *not across it*. For, in cross grinding it is exceedingly difficult to avoid cutting into the metal surfaces on each side of the weld. Where gages are light, the work should be backed up with something solid, a steel plate, or wooden block, to provide a firm grinding surface.

The grinding should be carried out along the length of the weld continuously and should not be stopped at any one spot. If a given area becomes too hot for the hand the operator should pass on to another until the former cools, otherwise the surface will buckle, or may even become burnt. Frequent applications of a wet rag or sponge are quite permissible and will hasten cooling.

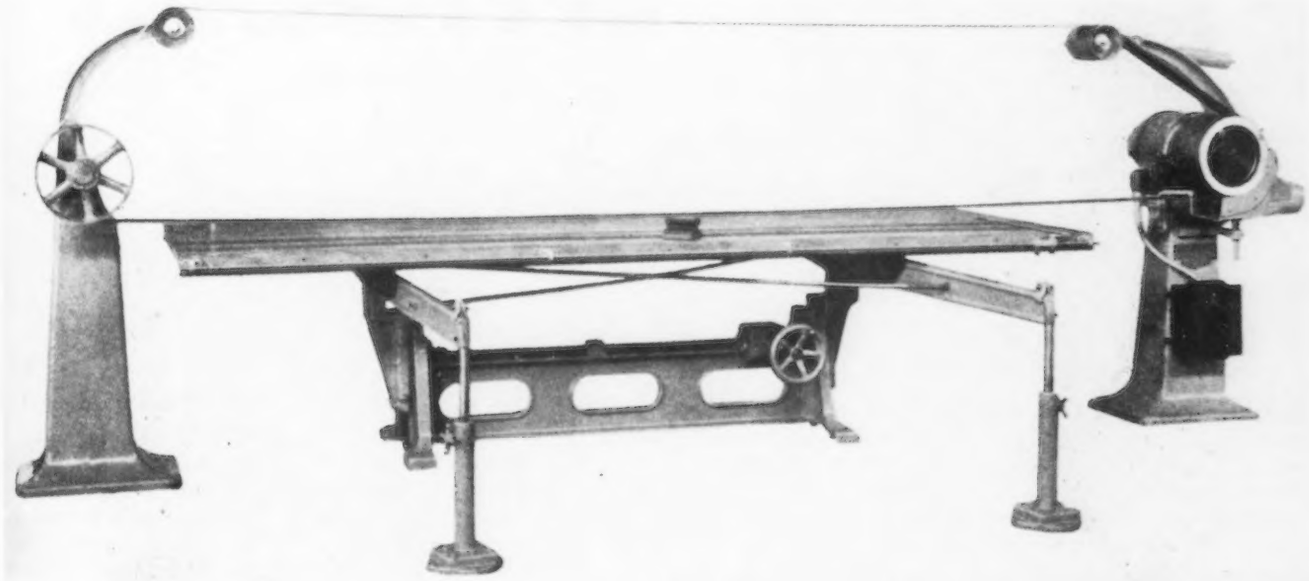
It is inadvisable to endeavor to hurry matters by bearing down on the wheel. Cutting efficiency depends mainly on wheel speed and grit size, and excess pressure will only result in rapid overheating.

If the bead is so rough that a coarse grit wheel has been necessary for the first cut, a finer grit wheel, such as No. 60 or No. 80, should be used for the second operation. If a highly finished surface is not required further grinding will then be unnecessary. But if the weld bead is to be removed completely and the surface polished to match the original surface a slightly raised region should be allowed to remain after rough grinding. This can then be removed with the finer grit wheel which, at the same time, will remove the deep scratches and cuts remaining from the coarse wheel. The second operation should continue until the region of the weld is flush with the original surface. Polishing may then proceed in accordance with instructions which follow, and lines should, if possible, run in the same direction as the polishing lines of the original surface.

For removal of ordinary small pits, seams, or other imperfections, begin with a wheel of moderate grit, such as No. 60. But if pits, or seams, are deep and much metal must be removed, a coarser numbered wheel will obviously be required.

Grinding with solid wheels must be carefully done to avoid gouging the surface and leaving a depression that will be difficult to smooth out. Wheels must, in all cases, be carefully trued

(CONTINUED ON PAGE 92)



Hand-block sander, as made by Minnesota Mining & Mfg. Co. For flat or nearly flat surfaces a curved-shoe hand-block is recommended.

Machinability Studies BASIC TO EFFICIENCY

By H. T. PENTECOST
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THE vertical drill press method employed by the General Electric Co. for making "ease of machining" determinations on various materials, and the use of an electrical surface comparator for testing finish, another important machinability consideration, are outlined in this article. The results of these investigations, coupled with data from other tests of physical characteristics, are of definite assistance to engineers in specifying both the material and its heat treatment for a particular product application. Tool life, the third phase of machinability, is also studied: for this supervisors in all departments furnish the fundamental data from which recommended practices are worked out.

THE importance of a working knowledge of the comparative ease with which various basic metallic materials may be machined has been stressed in the earliest training of every apprentice machinist. This knowledge coupled with the experience gained by shaping and forming an ever increasing list of practical engineering materials has been the basis on which most machinability studies in the past have depended. Unfortunately the accuracy of such studies has hinged largely on the individual's conception of such general terms as "Tough," "Fair," and "Easy," and often their final values have been accepted as fact only after combining the personal opinions of two or more qualified persons.

As a means of reducing the "human element" involved in machinability investigations, the Schenectady Works Laboratory of the General Electric Company has prepared an inexpensive, practical and effective mechanical "yardstick," which can be easily duplicated by even the smaller manufacturers, for accurately measuring the "ease" with which materials may be machined.

Vertical Drill Press Method

This, the first in a series of proposed similar mechanical aids for reducing "machinability" to its elemental components, consists of an ordinary vertical drill press with the necessary auxiliary equipment (Fig. 1) to closely control and keep constant the speed, to load and adjust for the desired amount of dead weight at the drill, and to travel 1 in. in a vertical direction.

The drills used in these studies are of standard 3/8 in. straight-shank jobbers' type, and all of one brand.

Care is taken to reduce to their minimum all the possible variables. Between tests, drills are kept as nearly similar in sharpness and point and clearance angles as is possible with the mechanical grinding aids afforded by a bench drill grinder. The drill press and auxiliary equipment are constantly inspected and lubricated to assure identical mechanical conditions for all tests.

In making "ease of machining" determinations on sample materials, the time required to drill a hole 1 in. deep is noted. The minimum time for drilling this hole in any one class of metal is determined by trial. By first increasing the load while maintaining constant speed and then increasing speed with constant load, an optimum load and speed are established which are kept constant while making comparisons of the materials of this particular class. It has been found that the difference in time for drilling the test holes in the various metals of one class under these conditions is directly proportional to the ease with which these metals may be worked in actual production shop practice.

This fact was admirably borne out early in the course of the development of this drill press machinability method and its value has since been

Table I—Machinability—Tool Room Report

Steel		SHAPER Speed (F.P.M.)	SHAPER Remarks	MILLER Speed 7½" Dia. (R.P.M.)	MILLER Feed (In.)	MILLER Cut (In.)	MILLER Remarks	SAW Speed (F.P.M.)	SAW Remarks	PROFILER Speed ½" Dia. (R.P.M.)	PROFILER Feed 1.P.M. (In.)	PROFILER Remarks	Drill	Tap
	*A	40	Tough				Very Tough	115	Fair	450			Fairly	Fairly
XE1	*B	60	Fair	21	1	1/16	Very Tough	115	Fair	450	1	Tough	Tough	Tough
	A	87	Easy				Tough	115	Fair	900				
2	B	60	Fair	21	1	1/16	Tough	115	Fair	900	0.8	Fair	Fair	Fair
	A	60	Fairly Tough				Tough	115	Fair	630				
3	B	60	Fairly Tough	21	1	1/16	Tough	115	Fair	630	0.8	Fair	Fair	Fair
	A	60	Fairly Tough				Tough	100	Fair	900				
4	B	60	Fair	21	1	1/16	Tough	100	Fair	900	0.8	Easy	Fair	Fair
	A	60	Fair				Fair	115	Fair	630				Fairly
5	B	40	Fairly Tough	21	1	1/16	Fair	115	Fair	630	1	Fair	Fair	Tough
	A	60	Fair				Tough	115	Fair	630				
6	B	60	Fair	21	1	1/16	Tough	115	Fair	630	1	Tough	Fair	Fair
	A	60	Fairly Tough				Very Tough	105	Tough	450				
7	B	60	Fairly Tough	21	1	1/16	Very Tough	105	Tough	450	0.8	Tough	Fair	Fair
	A		Fairly Tough				Tough	105	Tough	450				
8	B	40	Fairly Tough	21	1	1/16	Tough	105	Tough	450	0.8	Tough	Fair	Tough
	A	40	Fairly Tough				Tough	110	Tough	630				Fairly
9	B	40	Fairly Tough	21	1	1/16	Tough	110	Tough	630	0.8	Fair	Tough	Tough
	A	80	Easy				Tough	115	Easy	900				
10	B	80	Easy	21	1	1/16	Tough	115	Easy	900	0.8	Easy	Fair	Fair

* A and B designate first and second sample.

further proven by directly influencing the purchase and use of materials and tools which have thus resulted in considerable time and cost reductions.

Accuracy of Method Checked

To establish the accuracy of this new mechanical method of rating machinability as compared with methods used formerly, an interesting study was conducted on a group of 10 tool steels including six established varieties and four experimental compositions of the air hardening type. The steel was purchased in the form of hot rolled annealed bars 1½ in. thick and 6 in. wide.

These were machined to form a die having outside dimensions 1⅜ in. x 5⅞ in. x 9 in. The middle section was cut out to form a rectangular opening 3 in. x 6 in. The result might be described as a picture frame die 5⅞ in. x 9 in. outside, 3 in. x 6 in. inside and 1⅜ in. square section all around. (Fig. 2.)

Six machining operations were required to produce this die and each operation was assigned to a single highly skilled tool maker. Each tool maker rated the several steels (two pieces each, making 20 dies in all) according to his opinion of their ma-

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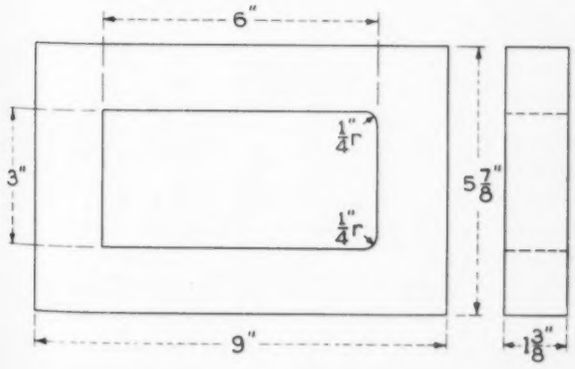
BELOW

FIG. 2—To check the accuracy of the drill press machinability method, a group of tool steel bars were machined to this form. The machining was done by highly skilled tool makers, who rated the several pieces according to their opinion.



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AT RIGHT

FIG. 1 — Vertical drill press equipped for accurately measuring the "ease" with which materials may be machined.

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Table II—Machining—Ratings Based on Tool-Room Report

Steel	Machine Operation: Shaper	Miller	Saw	Profiler	Drill	Tap	Total Points	Per Cent* Rating
XE-1	8	0	12	4	8	8	40	52.7
2	14	4	12	12	12	12	66	87.0
3	8	4	12	12	12	12	60	79.0
4	10	4	12	16	12	12	66	87.0
5	10	12	12	12	12	8	66	87.0
6	12	4	12	4	12	12	56	73.8
7	8	0	4	4	12	4	32	42.1
8	8	4	4	4	12	4	36	47.4
9	8	4	4	12	4	8	40	52.6
10	16	4	16	16	12	12	76	100.0

$$\text{* Rating} = \frac{\text{Total Points}}{76} \times 100 \text{ Per Cent}$$

chinability characteristics as shown in Table I.

To establish a numerical value for these findings, 100 was selected as representing best machinability. Since there were six operations, perfection in any one of them was assigned the value 100/6 or roughly 16. Since the five ratings covered the range in each operation from best to worst, "Easy" was assigned the full value of 16; "Fair" 12; "Fairly Tough" 8; "Tough" 4; and "Very Tough" 0. Substituting these numbers for the terms found in Table I gives the values found in Table II. In the right-hand column of this table the ratings are shown on a percentage basis considering the highest rated steel (76 points) as 100 per cent.

The pieces of steel removed from the middle section of the test "die" were used as samples on which drill machinability tests were made. Table III shows the results of these tests. Comparing the percentage rating found by both shop and drill press methods, it can be seen that steels numbers 10, 5, and 2 were considered best by both tests, while steels numbers 7 and 8 are at the bottom of the lists.

Considering the possible arbitrary nature of one of these test methods as compared with the mechanical and electrical precision of the other, it is most striking that the maximum and minimum results compare so closely and it is equally surprising that the intermediate values do not show wider discrepancies.

From this and other comparisons it was definitely concluded that in this drill-press machinability indicator, this company had a valuable and accurate "mechanical yardstick" with which to approach the many machinability problems with scientific precision.

Used Also to Study Heat Treatments

Besides making possible the accurate comparison of the ease of machining two or more metals of different composition as described above, this equipment was also successfully used to establish the effect of different heat treatments and resultant grain structures of various samples of identical chemical composition. One such investigation resulted in the elimination of a costly heat treatment with no additional expense in subsequent machining.

Machinability of course consists of factors other than the ease of machining or penetrating, the measuring of which this equipment was originally intended and for which it has since been used.

Finish and tool life are also important machinability considerations for which accurate "yardsticks" are in general demand.

For years the determination or comparison of finishes with various established standards has been the result of visual inspection by tool makers and machinists, the final interpretation being, as in the case of ease of machining, a compromise of personal opinions.

Surface Finish Investigated by Electrical Comparator

The General Electric's electrical surface comparator has proved to be an effective "yardstick" for this phase of machining and has replaced the former guesswork with a positive means of judging the quality of machined surfaces.

Briefly, this apparatus affords a means of positioning a hard, sharp-tipped stylus lightly but firmly against the surface of a moving sample. The small mechanical impulses which result as this hard point rides over the minute surface irregularities are transmitted to an electromagnetic pick-up which in turn transmits equivalent electrical impulses to a high gain amplifier. Accoustic instruments, oscillographs, or sensitive meters can be used in conjunction with this circuit to directly indicate or graphically record the surface characteristics of the sample.

Fig. 3 shows a set of surface readings taken on samples of standard General Electric finishes. No. 4 indicates the readings of the standard shaper finish; No. 3 indicates grinder finish. The wide indicated range of smoothness of these two finishes results from the fact that in both these finishes the actual smoothness varies with the direction of cut. Since profiling and rough lapping finish No. 2 and fine lapping finish No. 1 are used with circular motions the overall smoothness is more uniform.

Table III—Machining Ratings Based on Laboratory Drilling Tests

Effect of Load and Speed (Time in seconds to drill 3/8 in. hole 1 in. deep)

R.P.M.	Weight: 250 Lb.	300 Lb.	352 Lb.
300	108	89	76
400	82	—	52
500	61	—	47½

Note: These tests conducted on Steel XE-1.

Drilling Speed Tests at 352 Lb. Load (Time in seconds to drill 3/8 in. hole 1 in. deep)

Steel	R.P.M.: 300	400	500	Best Time	Per Cent* Rating
XE-1	76	52	47½	47½	53.7
2	61	46	36	36	71.0
3	104	75	54	54	47.3
4	80	59	41½	41½	61.5
5	45½	36	29½	29½	86.5
6	59	42	36½	36½	70.0
7	86	66	58	58	44.0
8	96½	65½	72	65½	39.0
9	82	53½	43	43	59.3
10	47½	29	25½	25½	100.0

$$\text{* Rating} = \frac{25.5}{\text{Time}} \times 100 \text{ Per Cent}$$

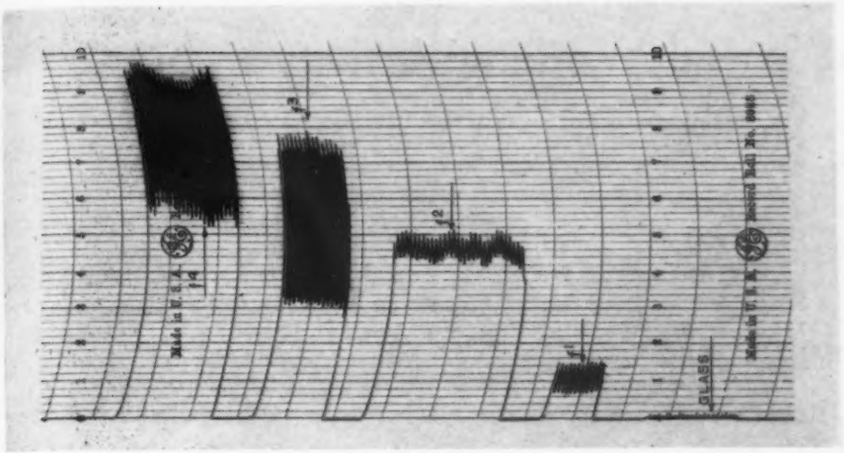


FIG. 3—For determining quality of finish, a G-E electrical surface comparator is used. This set of readings is from samples of standard G.-E. finishes.

With this equipment it is not only possible to study the surface characteristics of the various classes of finishes, but also to closely compare the finishes of any one class. This is particularly valuable, since it makes possible the exact determination of the effect of speed, feed and many other machining variables on the surface of machined parts.

Ease of machining and resultant finish, the first two phases of machinability and their respective mechanical and electrical determining aids as described here are of particular interest to engineers, and the information gained from these investigations, when coupled with that obtained from other tests of the physical characteristics of materials influence him largely in specifying both the material and its heat treatment for a particular product application.

Tool Life Also Studied

Tool life and all the variables which may affect it may be considered the third and last phase of machinability. This is undoubtedly most important to manufacturing men, for it largely determines the costs of practically all machining operations.

Besides the two material variables described above for which methods have been found for reducing to constants, such items as class of tool materials, hardness, angles, machine tools, speeds, feeds, coolants, and many others must be considered in determining tool life. The task of recording and interpreting all of the possible combinations of these variables for the purpose of supplying supervisors of machining operations practical "yardsticks" with which to judge their own performance will require considerable time. For that matter, with the advent of new machine tools and new materials the task may never be considered quite complete and will require the constant attention of an especially capable mechanical engineer.

Production records form the basis of these studies. Supervisors in all departments are supplied with questionnaires (Fig. 4) listing the many variables to which values are assigned as the individual machining jobs are performed. These performances are closely compared with others recorded under similar conditions, the best being selected as a basis on which to recommend future technique.

The information gathered from these studies often influences the selection and application of machine tools and tool alloys capable of higher speeds and feeds which result directly in appreciable reduction in machining time and increased tool life.

BELOW

FIG. 4—Machine and tool performance data supplied by supervisors in all departments form a basis on which to recommend future technique.

MACHINE AND TOOL PERFORMANCE DATA

This form is to be filled in for the purpose of accumulating data of your best performances in the machining operations mentioned below.

These data are being accumulated throughout the Company in order to establish, if possible, a practical yardstick to measure Machine and Tool performance. All information requested should be given.

WORKS Bloomfield Dept Screw Machine Date Aug. 17th

Type of Machine 1 1/2" G. A. Gridley Auto.

Condition of Machine Good

Type of Cutting Turning - Forming - Shaving - Threading & Cut-Off

Description of Work Piece Shaft

Dr. Number of Work Piece V-454885

Type of Material C.R.Steel Bar Stock

G.E. Spec. or S.A.E. No. B4B1

Brinell Hardness

Roughing Cut Rough Turn - Rough Form

Finish Cut - Describe Finish Must have a good finish on dec. dimension

Surface Speed F.P.M. Turning & forming 150

Depth Cut Form .375"

Feed per Revolution. Form .00105" - Turn .00293

Coolant Used 75% Parafine 25% Base

No. of Pieces per Grind 500

No. of Cu In. per Grind .093

Type of Tool Dovetail Form

Kind of Tool Material H.S.Steel

Rockwell Hardness 61 to 63

Top Side Rake 30

Top Back Rake 70

Clearance Angle 1 1/2°

Point Angle of Drill

REMARKS (or sketch) This job was formerly produced in two operations, present lay out on auto. makes the piece complete making an excellent reduction in cost.

Type of cutting. Turning, Boring, Facing, Cut Off, Planing, Shaping, Drilling through hole, blind hole, cored hole, conventional plain milling, climb milling, face milling.

SIGNED: John Doe

GO-1162 (1-39) New

Current Metal Working Activity

Latest Data Assembled by THE IRON AGE from Recognized Sources

Figures in italics are seven months' totals.

	September 1939	August 1939	July 1939	August 1938	Eight Months 1939	Eight Months 1938
Steel Ingots: (gross tons)						
Monthly output[a]	4,231,310	3,763,718	3,162,534	2,537,102	25,517,032	15,300,002
Average weekly output[a]	849,530	849,598	715,505	572,709	734,937	440,668
Per cent of capacity[a]	62.22	62.22	52.40	42.68	53.83	32.84
Pig Iron: (gross tons)						
Monthly output[b]	2,878,556	2,659,813	2,356,270	1,493,995	17,538,452	10,568,806
Raw Materials:						
Coke output[c] (net tons)		3,710,168	3,411,099	2,544,571	25,718,830	19,970,829
Lake Ore consumed[d] (gross tons)		3,775,132	3,143,337	2,076,819	23,889,355	14,654,873
Scrap Iron consumed[r] (gross tons)		2,919,000	2,551,000	1,953,000	19,920,000	11,774,000
Finished Steel: (net tons)						
Trackwork shipments[a]	4,916	5,402	5,330	3,036	31,041	15,717
Fabricated shape orders[f]		93,452	110,675	106,772	869,875	692,885
Fabricated plate orders[e]		21,828	31,364	22,069	230,229	196,286
U. S. Steel Corp. shipments[g]	985,030	803,822	676,309	558,634	5,873,397	4,010,558
Fabricated Products:						
Automobile production[h]	*290,000	103,343	218,478	96,946	2,377,489	1,552,897
Steel boiler orders[e] (sq. ft.)		889,829	772,094	782,665	6,901,016	4,905,978
Locomotives ordered[i]	52	5	4	18	156	96
Freight cars ordered[i]	24,231	315	0	303	9,392	8,327
Machine tool index[j]		206.5	230.9	120.9	216.3†	93.6†
Foundry equipment index[k]		131.4	111.9	83.3	126.8†	73.6†
Non-Ferrous Metals: (net tons, U. S. only)						
Lead shipments[l]		45,025	42,636	38,343	319,879	260,960
Lead stocks[l]		117,985	124,017	142,868		
Zinc shipments[m]	69,424	49,928	43,128	36,507	338,346	225,570
Zinc stocks[m]	95,615	122,814	131,782	141,997		
Tin deliveries[n] (gross tons)	5,050	6,295	5,275	3,775	41,570	34,300
Refined copper deliveries[o]			75,808	62,832	*411,660*	344,320
Refined copper stocks[o]			316,543	315,191		
Exports: (gross tons)						
Total iron and steel[p]		477,078	513,664	242,122	3,702,969	3,421,517
All rolled and finished steel[p]		151,134	132,675	100,467	1,066,502	921,525
Semi-finished steel[p]		15,587	16,970	3,688	103,569	170,787
Scrap[p]		290,346	347,249	106,867	2,413,610	2,017,654
Imports: (gross tons)						
Total iron and steel[p]		28,328	30,851	20,041	236,173	153,754
Pig iron[p]		3,204	6,189	961	25,247	22,262
All rolled and finished steel[p]		16,478	14,439	13,691	136,328	106,311
British Production: (gross tons)						
Pig iron[q]			743,600	443,000	*4,382,300*	4,956,200
Steel ingots[q]			1,153,100	658,900	*7,558,100*	7,268,600

†Three months' average. *Preliminary.

Source of data: [a] American Iron and Steel Institute; [b] THE IRON AGE; [c] Bureau of Mines; [d] Lake Superior Iron Ore Association; [e] Bureau of the Census; [f] American Institute of Steel Construction; [g] United States Steel Corp.; [h] Preliminary figures from Ward's Automotive Reports—Final figures from Bureau of the Census, U. S. and Canada; [i] *Railway Age*; [j] National Machine Tool Builders Association; [k] Foundry Equipment Manufacturers Association; [l] American Bureau of Metal Statistics; [m] American Zinc Institute; [n] New York Commodity Exchange; [o] Copper Institute; [p] Department of Commerce; [q] British Iron and Steel Federation; [r] Scrap Iron and Steel Institute.

THIS WEEK ON THE ASSEMBLY LINE

o o o

By W. F. SHERMAN
Detroit Editor

o o o

. . . Auto production rise halted by Chrysler shutdown . . . UAW-CIO demands closed shop and right to set production rates . . . Chrysler launches vigorous drive to bare cause of strike to public opinion.

DETROIT—An eight-week rise in automobile production has been brought to a halt by labor trouble in Chrysler plants which reached serious proportions in the last week. Assembly totals not only failed to reach the previous week's height but actually showed a decline of 235 units. A slowdown strike, "blood relative of the sitdown," paralyzed all plants of Chrysler Corp. and reduced output last week to 10,025 cars and trucks by Chrysler compared with 24,925 in the week before the strike got underway.

It is already apparent that Chrysler is a victim of one of the most unusual strikes in the history of labor organization. The union has no grievances, no complaints, asks no wage increases, and is satisfied with its hours of labor.

Before a normal level of production had been reached—in fact only eight days after new models were started on the assembly lines—the union raised its voice against "the speed-up." It asks now for a chance to regulate automobile production and to set its own standards of work.

Of course, these things weren't evident in the union's first broadsides against the corporation but then the CIO leaders could hardly have anticipated that Chrysler would "hang the washing on the line" to lay bare the absurdity of the charges and arguments raised by the UAW.

K. T. Keller, president, and Herman L. Weckler, vice-president in charge of operations for Chrysler, used vigorous terms and vigorous methods last week to bring the real cause of the strike to light. Apparently Chrysler has decided that the case for management will be tried in the court of public opinion.

Conflict Brought Into Open

Challenging statements by Chrysler officials in the last week have forced the union's spokesmen into the open air in a record-breaking fashion. As a result, the public and factory workers, including Chrysler employees, know more about this strike than any in the industry to date. It's a big change from the usual procedure.

Conferences behind closed doors have a tendency to "leak out" and reveal a different story than that told in press communiques which form the usual bases for newspaper stories about the progress of strikes and strike negotiations. Anyone long concerned in the subject can verify the fact that negotiating committees drag a lot of red herring in most instances. When the facts are all made public, negotiating committee tactics usually need substantial revision.

HERMAN L. WECKLER, Chrysler vice-president, who has addressed a vigorous letter to UAW-CIO union head.

Apparently the older type of tactics was being used when the union dug up from its files 13 already-judged grievance cases and tried to make these an issue when all it really wanted to do was to find a way to control the output of automobiles.

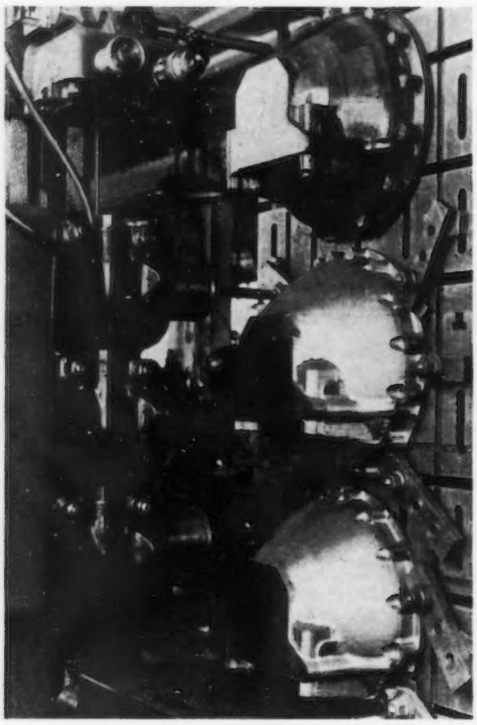
Observation would indicate that the union has simply run out of other things to talk about. As regards conditions of labor, Chrysler has been recognized as extremely liberal in its policies. Was production speeded up too much when workmen could leave assembly line jobs to buy fruits and candy bars, to drink Coca-Cola or step away from the assembly line for a smoke? Conditions like these prevailed for a long time before union tactics caused the removal of canteen counters in various parts of the factory buildings about two years ago.

The UAW has run the gamut—it staged its 1937 sitdown at Chrysler, entertained itself with numerous minor strikes, intra-union quarrels previous to Homer Martin's ouster, and then argued with the AFL until finally an NLRB election resulted in certification of the UAW-CIO as sole bargaining agent. The union sought and obtained five extensions of the contract signed with Chrysler in March, 1937. Having exhausted the list of demands which it has imposed upon Chrysler and the rest of the auto industry, except Ford, the UAW has unleashed its newest and strangest "program" with a definitely pink cast.

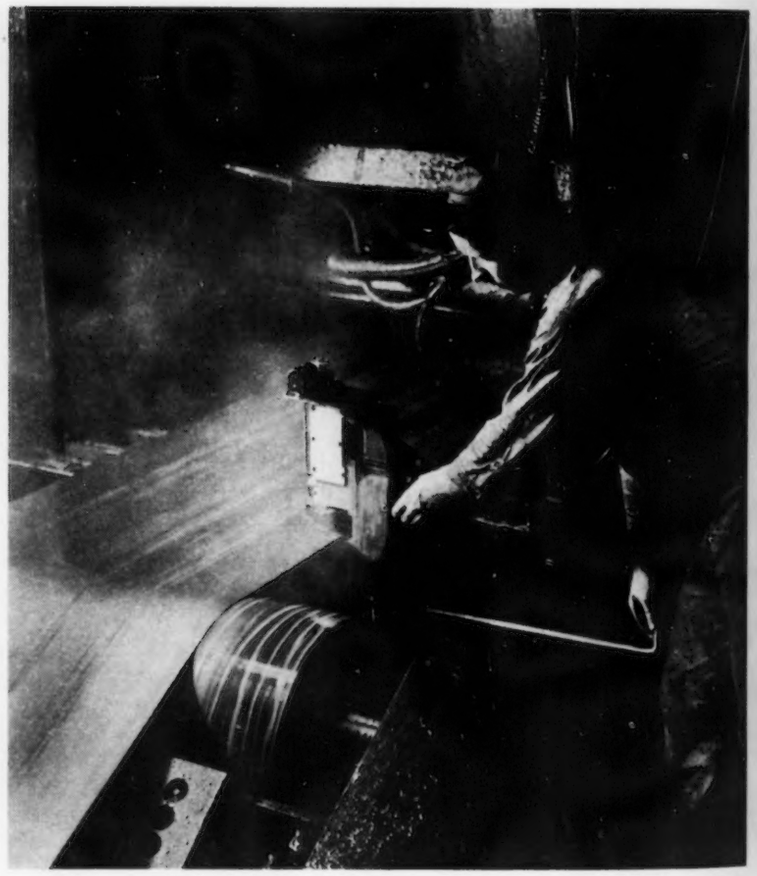
Letter to Union Head

In a frank letter to the union's Richard T. Frankensteen, Chrysler's

When production schedules speed up...you need DEPENDABLE



The ability to produce accurate tools and dies rapidly is essential in keeping up with heavy schedules. The Keller Automatic Tool Room Machine, made in several sizes, is the ideal equipment. It reproduces accurately in steel the form of a template or the shape of a wood or plaster master. The machine is equally valuable for making complicated experimental parts.



Pratt & Whitney gage engineers are experts in safeguarding production accuracy. The "flying mike," shown above, typical of their ingenuity, is an adaptation of the Electrolimit Gage principle which increased strip mill rolling speeds from 200 up to 1500 feet a minute and maintained closer tolerances! Pratt & Whitney gages, both standard and special, can govern your production limits from beginning to end, and insure a uniformly accurate product. They cut down spoilage and reduce assembly costs. Accurate gaging control thru every manufacturing step is essential in maintaining trouble-free production.

Cutting tools that shape and form metal into finished parts must be accurate—and tough to maintain that accuracy. Pratt & Whitney standard milling cutters, taps, dies, reamers, end mills and hundreds of special tools are the products of small tool specialists. Each is designed for a particular job, and heat treated accordingly. When you use P&W Small Tools you have top performance and efficiency.

PRECISION

Pratt & Whitney Jig Borers, like the one above, do the all important precision boring work on jigs and fixtures. They have been standard tool room equipment for twenty years—and have always paid dividends.

THERE is no substitute for dependable precision. Too often the assembly line must correct faults and errors that would not exist if production had been accurate. That means trouble—and poor performance of your product later on.

Eliminating assembly troubles and inaccuracies is one of the greatest trials of production engineers. The best remedy is careful precision from start to finish. If you will install accurate equipment that can maintain the limits your engineers set, your parts will assemble smoothly.

Pratt & Whitney precision machine tools, small tools and gages are built by master craftsmen. The precision built into these machines and tools is passed on to the products they turn out. That initial and lasting accuracy pays dividends that in turn more than justify the cost of this high grade equipment. There is no better paying investment than Pratt & Whitney dependable precision. Our sales engineers in your territory can assist you in getting the kind of machines and tools that will maintain your speeded up shop schedules. Call them in.

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND CO.

Hartford · · · Connecticut · · · U. S. A.

Vice-president Herman L. Weckler pulls no punches. His letter in part follows:

Mr. Richard T. Frankensteen,
1238 Maccabees Building,
Detroit, Mich.
Dear Sir:

What you said in your letter of Oct. 7 has since been modified by what you said in our conference yesterday. Furthermore, during the conference you stated you wanted an answer by Friday, Oct. 13, and not by Tuesday, Oct. 10, at 5:00 p.m., as you stated in your letter and to the press. This letter will answer both sets of your proposals.

But first of all, let us get the record straight because some of the statements in your letter just do not square with the facts.

The trouble at Dodge is not due either to "unjustified discharges" or "arbitrary standards" of production. Your "atrocity" stories do not stand up.

The trouble at Dodge is due to your attempt to take control of production, to build up a case prior to the new contract negotiations and to make a show of force.

Under union instructions, a number of employees, paid to do a fair day's work, took it into their own hands to say what would or would not be produced. They let bodies and fenders go by unpainted, and did other things to slow up and disrupt the orderly operation of the plant.

We worked with this problem for weeks, and at all times with the union shop committee, the local, and the International Union, hoping to get your union's cooperation in straightening it out. Instead, you extended the slowdown and got it organized so that the men did not dare do the work they were paid to do.

And when we suspended or dismissed some of the most flagrant offenders last Friday — after repeated warnings — you then so struck production that you made it impossible to operate the plant at all.

Now, what is it that you propose to do to meet this immediate situation?

The net of what you proposed yesterday is that the men who refused to do their work properly be taken back as though nothing had happened, and that the slow-down continue as it was going on before the dismissals.

You also said you would be willing to look into the matter and decide, on investigation, whether the men actually were slowing up production.

Obviously, this proposal doesn't make sense.

Now, as regards the proposals in your letter of Oct. 7.

First, as to production standards; these have been established with long experience and history, and fair adjustments have been made from time to time where willing cooperation of the workers made intelligent analysis possible. That has happened in the past and we expect it to happen in the future. We do not ask any man to do more than he is reasonably able to do. We ask only an honest day's work.

There is no speed-up in our plants and the present trouble is not due to any speed-up.

It was not a matter of being unfamiliar with machinery for new models, as you say. The operations are parallel with those of last year and no more individual effort is required.

Production schedules are the management's function. You may as well know now that we do not intend to give your union control of production.

Second, as to discharge cases; you cite 13 cases over the last two and one-half years and ask that they be arbitrated. These cases have all gone through the machinery set up for handling such cases by the contract we had with you. They were fairly and thoroughly considered. As examples of that: three of these cases go back to the Plymouth riot, started by members of your union in August, 1937. These three men you agreed should be discharged, and we agreed not to discharge a lot more who should have been fired at the same time.

As to negotiations for a new contract; we had a contract with the union from March, 1937, to September 30, 1939. You thought well of it when you made it. We accepted it and lived up to it. When you got into a factional row last spring in your union and both factions needed time to try to straighten it out, we accommodated with five extensions beyond its expiration date.

When you decided against a further extension, you began to trump up false charges, to dig up so-called grievances and to concoct speed-up claims that you should know are unfounded.

What you are doing is the old camouflage, Frankensteen, and you know it. So do we. So do the men in the plants. So does the public.

Now you want a new contract and we are willing to negotiate with you. So you bring in your negotiating committee and your demands and let's get down to business. We are ready again to make a fair contract, but not to let you run the plants.

If the men are prepared to do a fair day's work for a fair day's pay, we have the orders on hand to put them to work. If the union's instructions keep them from working, the responsibility is yours.

Yours very truly,
Herman L. Weckler.

Note: Italics are the editor's.

The union's only other demand—for a union shop, tantamount to a closed shop — was flatly rejected Friday by

THE BULL OF THE WOODS — BY J. R. WILLIAMS

DE ROOF HE'S LEAK, DE PLESTER HE'S FALL ON DE HEAD, DE PIPES HE'S BUST, DE STAIRS HE'S BROKE-- I NO PAY DE RENT TEEL HE'S FEEX!
POOR OL' DAVE-- HE SAVED AN' SKIMPED TO BUY A COUPLE OF HOUSES TO RENT SO HE COULD GET OUT OF TH' WORKING CLASS --HE'S MORE IN IT THAN EVER
I THINK HE MUST TAKE THE STUFF OFF ONE TO FIX THE OTHER, BECAUSE HE'S NO MORE THRU WITH ONE THAN THE OTHER NEEDS TH' SAME!
COPR. 1939 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.
THE NICKEL NURSER
J.R.WILLIAMS 10-14

Chrysler management in a meeting to discuss the controversy which has thrown 55,000 men in Chrysler off their jobs and had seriously affected a large number of employees in supplying plants.

Other manufacturers continue to increase output with indications that continuance of present schedules will result in manufacture of 1,250,000 cars and trucks during the last quarter of 1939, an all-time high mark for the period. The highest production in the last quarter of any year previous was 1,154,806 in the year 1936.

Accordiog to Ward's Automotive Reports, assemblies of passenger cars and trucks in the United States and Canada last week totaled 75,860 compared with 76,095 in the previous week and 43,540 in the corresponding week of 1938.

General Motors plant completed 34,260 units, compared with 24,272 a week earlier. Chevrolet hit a 17,000 rate, compared with 9400 a week earlier. Plymouth output for the week dropped from 12,400 to 6900. Ford continued its upward climb from 13,250 Fords and Mercurys to 18,500. Zephyr output climbed from 360 to 400.

1939-40 Directory of Materials

MACHINE Design's Directory of Materials (seventh edition), for 1939-40 is now available.

The new edition is a complete revision of previous directories and the materials listed comprise practically a complete list of all materials in general use by engineers and designers of machinery.

The directory is divided into eight sections, each a complete directory of materials of similar type. The sections are: iron, steel and non-ferrous alloys; plastics and other non-metallics; iron, steel and non-ferrous producers; plastics and non-metallics producers; stampings producers; forgings producers; die castings producers, and custom molders.

A helpful feature of the directory is the keyed explanation of each material's characteristics. A user of materials may, without difficulty and lost time, locate immediately any material with given characteristics in which he is interested.

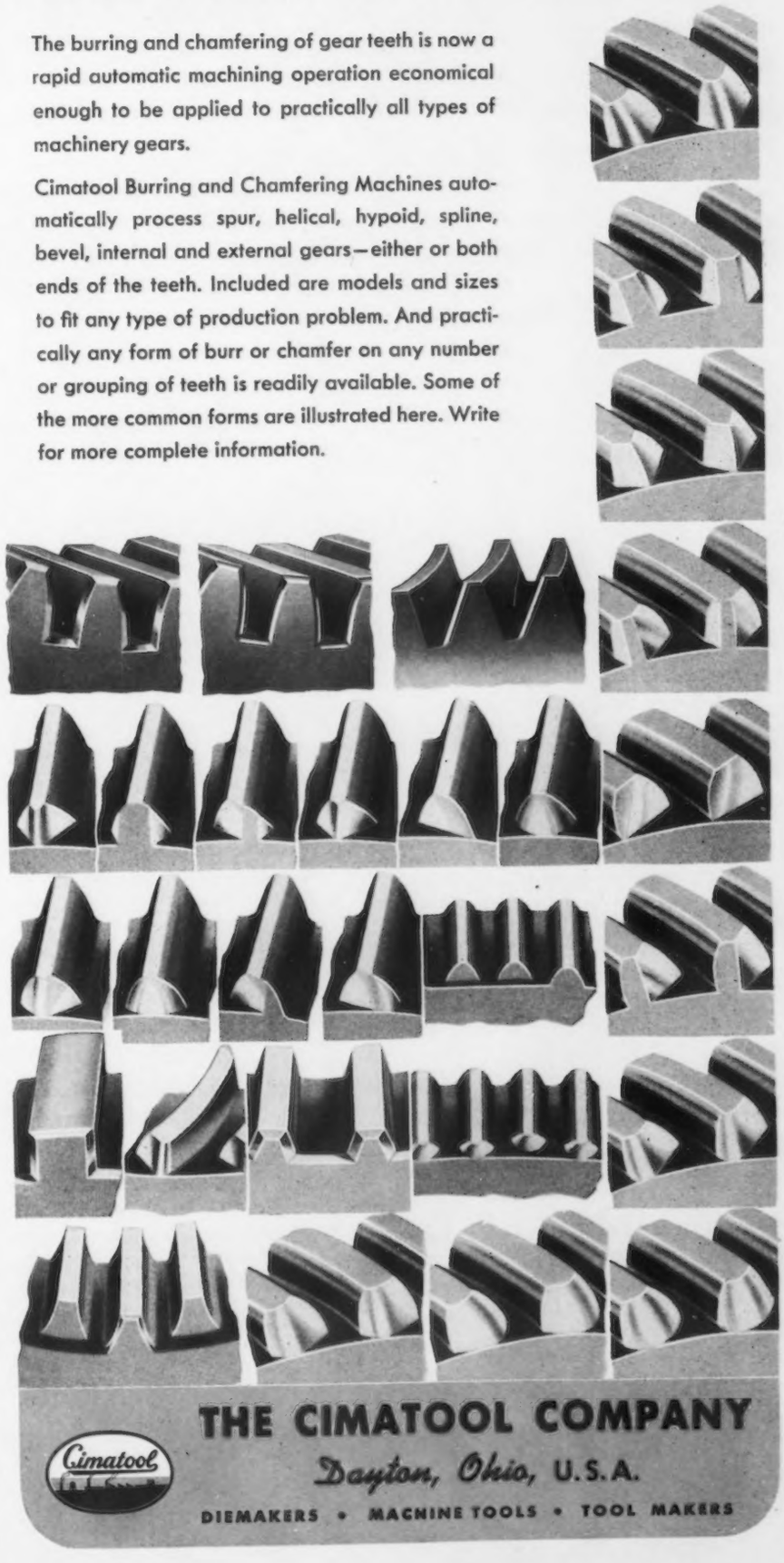
Copies of the directory are available at a nominal charge of 25c. postpaid, from Machine Design, Penton Building, Cleveland.

A. Milne & Co., 745 Washington St., New York, announce their appointment as correspondents in the United States for the English Steel Corp., Ltd., Vickers Works, Sheffield, Eng.

Automatic BURRING AND CHAMFERING OF GEAR TEETH

The burring and chamfering of gear teeth is now a rapid automatic machining operation economical enough to be applied to practically all types of machinery gears.

Cimatool Burring and Chamfering Machines automatically process spur, helical, hypoid, spline, bevel, internal and external gears—either or both ends of the teeth. Included are models and sizes to fit any type of production problem. And practically any form of burr or chamfer on any number or grouping of teeth is readily available. Some of the more common forms are illustrated here. Write for more complete information.



THE CIMATOOL COMPANY

Dayton, Ohio, U.S.A.

Cimatool

DIEMAKERS • MACHINE TOOLS • TOOL MAKERS

THIS WEEK IN WASHINGTON

. . . New Deal afraid of a war boom and resultant collapse when peace comes . . . Various Government agencies sending out distress flares . . . Government departments also concerned over Walsh-Healey wage decision . . . Army and Navy warn against exports of strategic materials.

o o o

By L. W. MOFFETT
The Iron Age

o o o

WASHINGTON — Sticking out like a sore thumb fear of violent reaction on the country's economic structure if European peace should come suddenly pervades the Administration. Naturally anxious that the war should come to an immediate end, its aftermath as it will affect industry and employment is nevertheless the source of endless conferences, plans, and statements.

High notes that are sounded to cushion an upset situation warn against "unjustified" price rises, excessive inventories and speculative buying, a closely related trinity.

Accustomed to lagging industry and vast unemployment, whose only means of alleviation have been Government shots-in-the-arm, the New Deal now ironically finds itself concerned over the rapid rise in privately sponsored industrial activity, afraid of a war boom that will get out of hand and be followed by an inevitable deflation through halted production and employment with a crashing price structure. The feeling exists throughout the Government with many of its departments actively seeking to prevent the ugly situation they visualize unless industry heeds their warnings. Principal Government agencies in actively shooting off distress flares are the Department of Justice, the Department of Commerce, the Treasury Department, and the Federal Reserve Board.

Industry Also Sounds Warnings

It so happens that industry, profiting from experience of the 1914-18 World War, rather extensively recognized the signs now present and it, not the Government, took the initiative in sounding warnings. Industry generally is urging peace for the sake of peace, pointing to the threat to the American economic system if the United States should become involved in war, and has exercised retraints against artificialities arising from an actual or potential war boom. While in instances such factors as prices and inventories are conceded to have got out of control, it is the common opinion in both Government and private circles that much already has been done to reduce the dislocation of industry both during and following the war. It is realized that shocks are inescapable but that they can be softened. Private industry to a considerable degree is working in close cooperation with the Government and is as eager as the Government to guard against the dangers of a war boom. Organized labor, as reflected by remarks of CIO's John L. Lewis and AFL's William Green likewise are sounding warnings of the danger to wages, in terms of purchasing power, if a war boom gets under way and skyrockets prices. Organized labor, too, in insisting that the United States keep out of the European war, is moved not only by the motive for peace, but also shares with industry the fear of rigid Government control and apprehension lest it be made permanent even after hostilities have ended. To many the view is held that even if such permanent control did not eventuate industry would escape with a hardly less penalty in the way of taxes so high as to amount almost to confiscation.

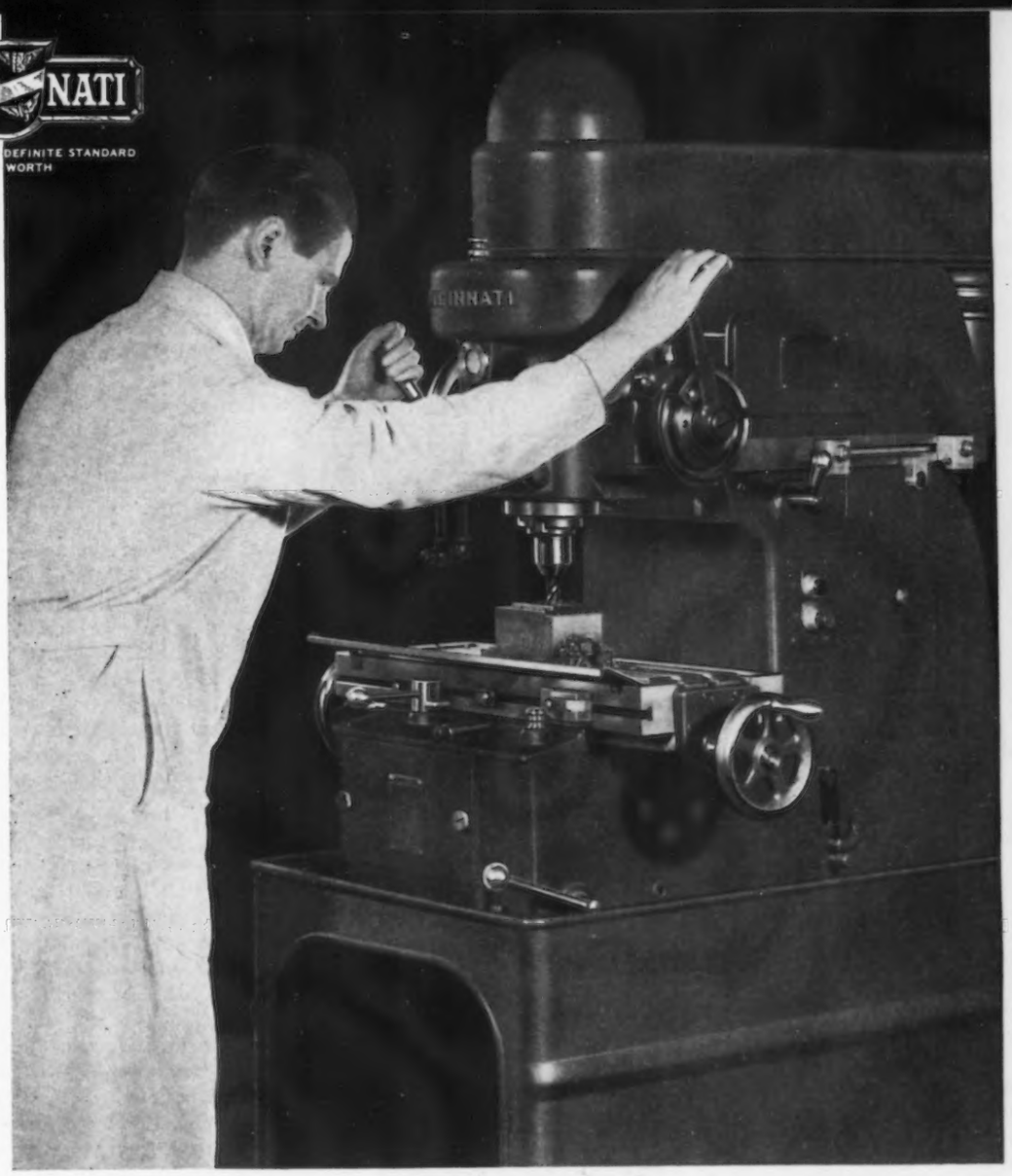
Warning by Hopkins

In warning that a realistic attitude is necessary to avoid an over-accumulation of inventories and a premature rise in prices of finished products, Secretary of Commerce Harry L. Hopkins said that the spurt in production has not been matched to date by greater consumption by the public or in capital expenditures by business for plant expansion and equipment. He declared that the most spectacular development among immediate economic reactions to the outbreak of war in Europe was the upward spurt in prices of basic commodities. He did not name the commodities but in taking a similar position Trust Buster Thurman Arnold named food products as an outstanding example. Mr. Hopkins pointed out that heavy buying took place in anticipation of rising prices and possible difficulties in securing deliveries, with a resultant sharp advance in the rate of business improvement that had been under way during the summer. The rapid rise in production and the increased movement of goods into trade channels were declared to have led to a substantial increase in inventories of business concerns. Mr. Arnold attributed the start of the sudden price rise, which occurred at the outbreak of the European war to public hysteria but added that it owed its continuance "to the highly organized character of our agencies for the distribution of goods." Undersecretary of Commerce Edward J. Noble, pleading for "industrial statesmanship," has said that a skyward leap of the price structure, undue expansion of capital facilities, unnecessarily large inventories or reserves at inflated prices will result in an extended period of deflation, accompanied by unemployment, distress and lack of profit. The "seller's" market of today, he said, may be converted into a "buyer's" market tomorrow. Mr. Hopkins expressed the same view when he urged policies aimed at higher profits based upon larger volume rather than "the pursuit of ephemeral profits through price advances."

The Department of Commerce's Business Advisory Council has developed no definite plans or recommendations but is offering its services to any industry seeking help on such subjects as "profiteering"—defined, for want of a better definition, as "excessive profits"—tax and price-fixing legislation. The council has recognized that the difficult job for business is to find a spot for prices ranging somewhere below a so-called profiteering level but at the same time allowing

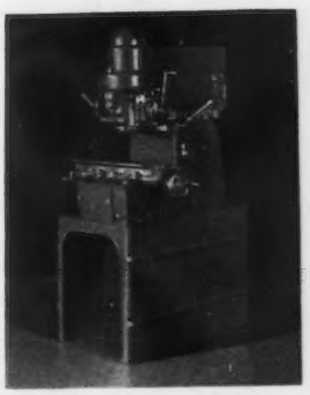
CINCINNATI

A SYMBOL OF A DEFINITE STANDARD OF WORTH



NEW CINCINNATI No. 0-8 VERTICAL MILLER

. . . For Small Work Exclusively



● Designed exclusively for milling operations on small parts, the new CINCINNATI No. 0-8 Vertical Milling Machine has all the convenient features so desirable for this type of work. Manufacturers of sewing machines, business machines, household refrigerators, etc., are finding this new miller a real profit maker.

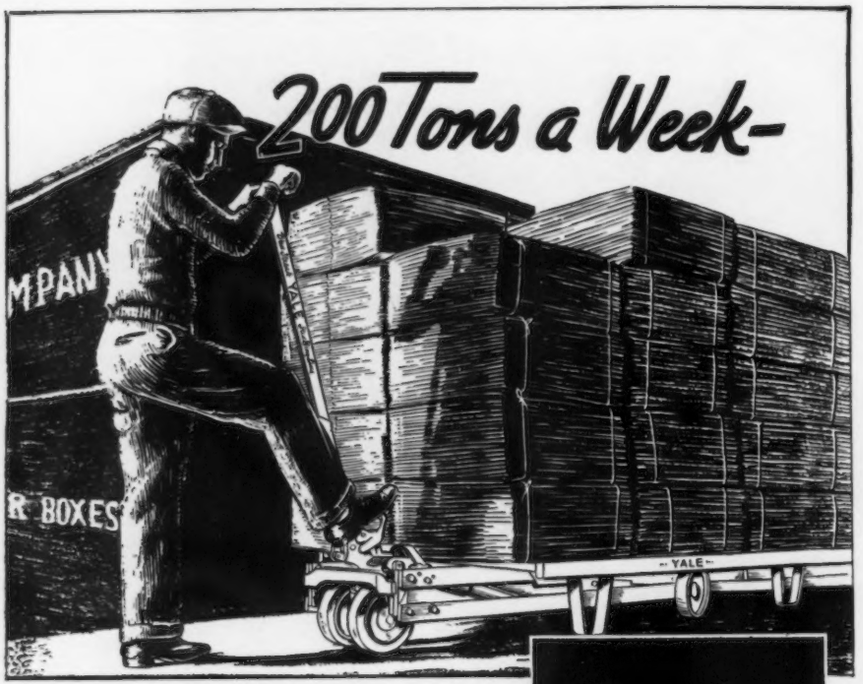
Both hand and power table feed movements and power table traverse of 100" a minute provide sufficient versatility for small lots or quantity production. Vertical hand feed, obtained through the spindle quill design, is controlled by the lever at the left of the spindle head. A positive and adjustable stop for the vertical movement eliminates cut-and-try for accurate depth of cut.

Cross movement is obtained by adjusting the spindle head over wide and accurately fitted dovetail ways on the column. Other features are listed in a new circular just off the press. Write for your copy.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED

Manufacturers of

Tool Room and Manufacturing Milling Machines
Surface Broaching Machines Centertype Grinding Machines Cutter Sharpening Machines
Centerless Grinding Machines Centerless Lapping Machines



HANDLED BY YALE LIFT TRUCKS

200 tons of corrugated boxes a week —a lot of paper for *any* trucks. But that's the job that YALE Lift Trucks perform for the Great Southern Box Company every week in the year. And perform perfectly!

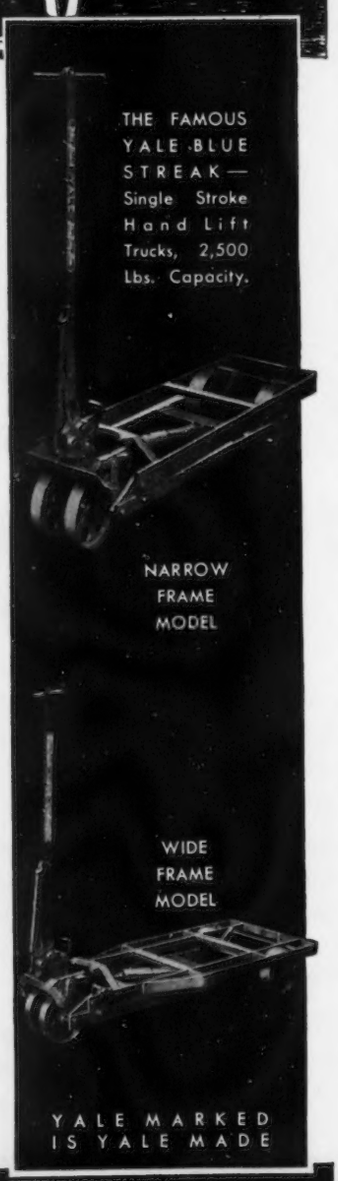
Following are some excerpts from a letter written by Mr. A. O'Shaughnessy, Vice-President of the Great Southern Box Company:

"The YALE system of hand lift trucks and skid platforms is the most efficient system of handling our product that we know of. We could not do without it. Maintenance cost is remarkably low — practically nothing. The Blue Streak is the easiest and fastest truck to operate that we have ever used. It is impossible to get a 'flying handle', and we have never had an accident of any kind. ***You cannot improve on YALE service.***"

"You Cannot Improve on Yale Service"—the keynote of YALE success!

Every truck that leaves our plant is the best of its kind. The safest—the most economical—the most efficient. Profit by the experience of industrial executives like Mr. O'Shaughnessy. BUY YALE!

Look in the phone book for your nearest YALE representative.


THE FAMOUS YALE BLUE STREAK— Single Stroke Hand Lift Trucks, 2,500 Lbs. Capacity.
NARROW FRAME MODEL
WIDE FRAME MODEL
YALE MARKED IS YALE MADE

YALE

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

enough margin to take care of increased costs. Except for the inveterate business baiters among them, Government officials realize the difference between legitimate price increases and profiteering and that in some industries higher levels are expected as the result of such factors as increased costs of raw material.

Some Higher Prices Justified

Whether or not Washington returns to character and makes a whipping boy of steel, just at present the industry is experiencing the unique sensation of getting a pat on the back from the New Deal for reaffirming of prices for the fourth quarter. Subsequent advances in prices on lines which have shown particular weakness, to apply on deliveries over the remainder of the year, met with no criticism and it is apparently recognized that by reason of increased prices of raw materials higher levels for the first quarter are justified.

But the New Deal takes credit for holding down prices of steel and other products. Mr. Arnold in an address last week before the American Retail Federation said that potential enforcement of the anti-trust laws on industry in general has been marked in the past few weeks. The steel, sulphur, potash and newsprint industries, he said, are under investigation by the Department of Justice. He added that "In no industry which the Department of Justice is actively investigating has there been any price rise due to war conditions." Apparently in the case of the steel investigation Mr. Arnold referred to the TNEC inquiry and not to any criminal action. On the other hand, said Mr. Arnold, "there has been a spectacular increase in similar commodities which have not been under investigation."

Mr. Arnold declared it is not correct to say that these results—restraint of prices—are caused by threats or that industry has been bludgeoned into compliance. Rather, he attributed the results to cooperation between industry and Government, adding that business men are law-abiding citizens and in general do not want run-away prices.

"Faced with a situation where the enforcing agencies are not interested, where there is no referee functioning, no one likes to stand alone as a chiseler or to explain to his stockholders why he declined to take the short-run profits which were there for the taking," said Mr. Arnold. "The effect of the active investigation by the Anti-trust Division is to compel business men to think over the long-run conduct of their business as opposed to the short-run profit."

Mr. Arnold said that one of the most important effects of anti-trust enforcement may well be the organization of consumers, pointing out that such organization has already advanced beyond anything known at the time of the last war. He suggested that the experience of the Consumers' Counsel in the Department of Agriculture be utilized for such an organization. Making an invariable plea of all Government bureaucrats, Mr. Arnold said funds and personnel are immediately needed by the Department of Justice to investigate complaints of price increases, to prosecute where such action is warranted, and to refer to other agencies with more general advisory powers or more direct access to legislation situations disclosed by complaints in which anti-trust laws are inadequate. Out of such references and analysis, he said, necessary new legislation can be fitted to the particular problem. He then proposed organization of rapidly growing consumer groups "into a force which in itself is capable of resisting profiteering."

Mr. Arnold expressed regret that the Department of Justice can impose penalties only by criminal indictment but said he hoped that legislation will be passed which will provide civil penalties.

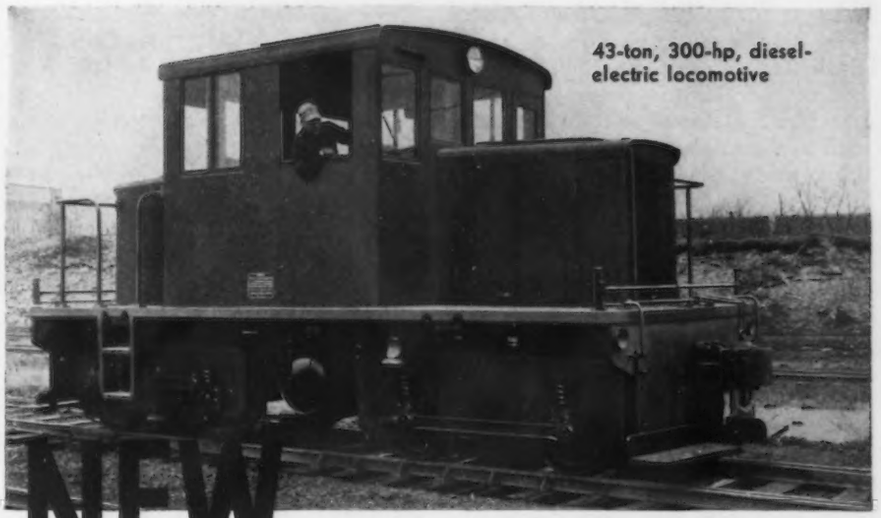
As a basis for its study on prices, the Department of Commerce is collecting inventory figures which will be placed at the disposal of the Business Advisory Council. These factors are entering into the discussions: that consumer groups are becoming increasingly vocal in their demands and hence are rapidly developing into formidable pressure groups. Some members of the council point out that, while it would be distasteful to business, the TNEC could use its subpoena powers to get facts and figures from business groups whereas if industry attempted to compile them itself it would run the risk of anti-trust law violation.

Dr. Isador Lubin, Commissioner of Labor Statistics, has stated that the country is beginning a stage in the economic process which may mean relatively little market changes in the employment payroll or it may mean a boom which might be short-lived and which might have disastrous repercussions.

Gloomy Employment Picture

He has declared that the upswing in employment started before war broke out and was given a push by the war boom but not enough to absorb all the employment. He said it is expected to absorb about 50 per cent. He painted a rather gloomy picture regarding the

They're Sure-fire Cost-cutters



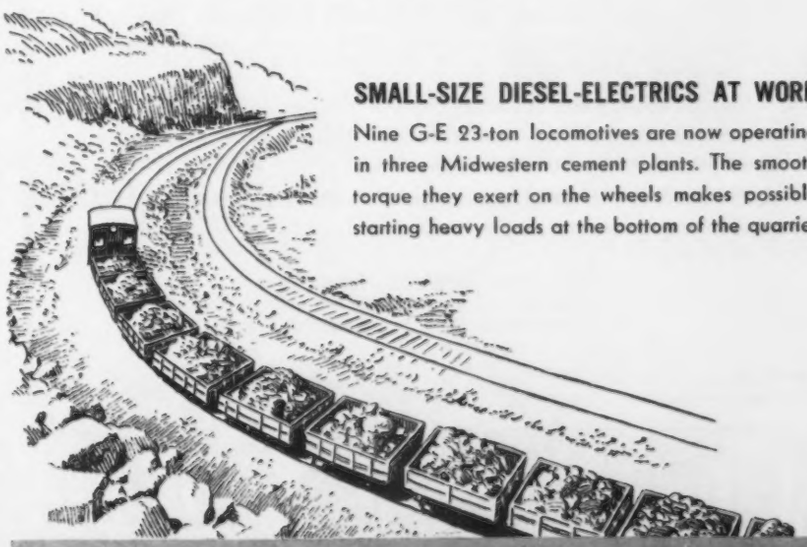
43-ton, 300-hp, diesel-electric locomotive

NEW SMALL DIESEL-ELECTRICS

THEY save money in fuel and maintenance costs. They reduce wear on cars and track because they run smoothly. They are easy to handle because of the simple electrical control. They are available for work most of the time. And now you can get them at the lowest prices in diesel-electric history.

General Electric has built a large number of these locomotives in the larger sizes for both railroad and industrial switching work, and the operating data obtained show that in most cases they pay for themselves in a remarkably short time.

Why not investigate the savings possible in hauling or switching work with our small-size diesel-electrics. Call the nearest G-E office and one of our representatives will be glad to talk this over with you. General Electric, Schenectady, N. Y.



SMALL-SIZE DIESEL-ELECTRICS AT WORK

Nine G-E 23-ton locomotives are now operating in three Midwestern cement plants. The smooth torque they exert on the wheels makes possible starting heavy loads at the bottom of the quarries

GENERAL ELECTRIC

250-37

employment situation. On top of the upward trend, Dr. Lubin said, the immediate effects of war were felt in aviation, shipbuilding and steel. Activity in durable goods was said to have reached 84 per cent of the 1937 level. But despite "high increases in industries directly affected by the war boom, such as the airplane industry, steel industry and shipbuilding industry," Dr. Lubin declared that the figures do not point to any tremendous boom which will absorb any large part of the unemployment.

Another U.S. Warning Against Exporting Strategic Materials

WASHINGTON—Following up President Roosevelt's press conference announcement on the necessity of keeping at home supplies of strategic and critical materials of which this country has an inadequate supply, the Army and Navy Munitions Board last week warned against exporting defense materials "essential to the industrial economy." It listed antimony, chromium, manganese (ferrograde), tin, tungsten, manila fiber, quartz crystal, quicksilver, quinine, rubber and silk, as the materials with which the War and Navy Departments are most concerned.

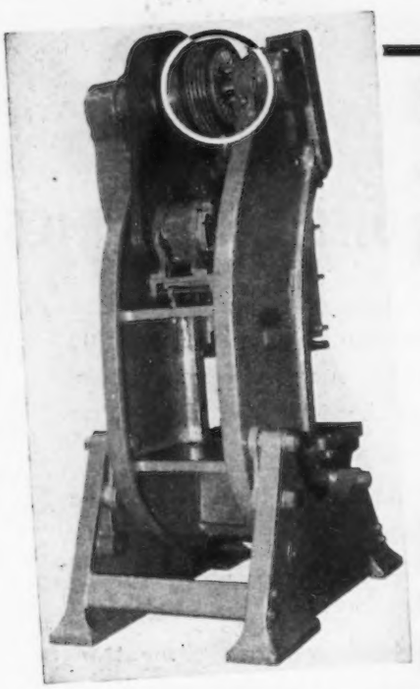
Insisting that the emergency stock program inaugurated under the Strategic and Critical Materials Act will be nullified if materials normally in stock, but not owned by the Government, are exported, the board added:

"Since the outbreak of the present war in Europe, foreign purchasers have either obtained or are attempting to obtain for shipment abroad supplies of these strategic materials which have been imported into this country by private interests for use by American industry."

The statement estimated that activities of foreign buyers have resulted in the removal of about 10,000 tons of rubber and an appreciable amount of tin from the market since Sept. 1 and that attempts also have been made to obtain ferromanganese and quantities of other strategic materials, either in a raw or semi-finished form.

Such sales, the board continued, are condemned by the more patriotic and responsible dealers and manufacturers in the United States who are cooperating with the Army and Navy Munitions Board in its effort to increase the supply of these materials within the country. It characterized as "imprudent" shipments to foreign countries of "those materials which can be replaced only by imports," emphasizing that at the present time it is becoming increasingly difficult and expensive to secure even the minimum imports of many of the materials listed.

There was no intimation that Mr. Roosevelt's "word to the wise," made several weeks ago when the subject was first brought up, had created the desired effect. The statement explained that the warning was being issued "to answer numerous queries that have been made upon the Army and Navy Munitions Board with reference to exports of strategic materials."



HIGH SPEED,
electrically POWERED
PUNCHING
with
Stearns
MAGNETIC
CLUTCH and
BRAKE UNIT

Fast, accurate, dependable, safe operation of this punch press was demanded by a large automobile maker. And—

He's getting it with the STEARNS Magnetic Clutch and Brake Combination (note circle) installed by the designer of the press.

There are many exacting power transmission problems being solved successfully with STEARNS magnetic clutches, brakes and clutch-brake units.

If you have a problem in power transmission, either in your plant or in your product, consult STEARNS engineers.

OUR NEW CATALOG, BULLETIN 225, IS FULL OF INTERESTING INFORMATION ON THE SUBJECT. WRITE FOR IT.

SEPARATORS — DRUMS — ROLLS
CLUTCHES — BRAKES — MAGNETS

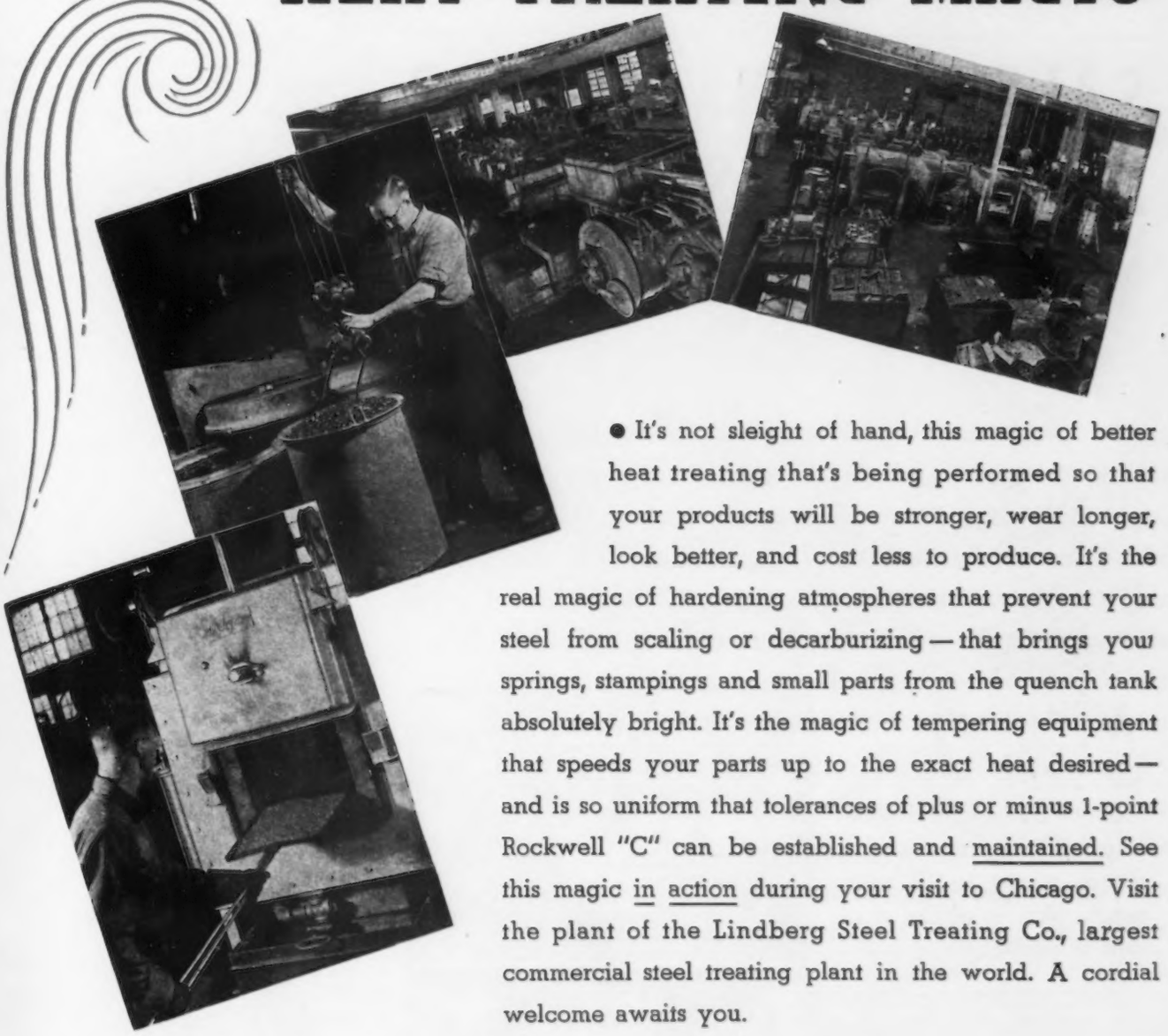
STEARNS
STEARNS-MAGNETIC MILWAUKEE
MAGNETIC MFG. CO.
635 So. 28th Street, Milwaukee, Wis.

TNEC Steel Hearings Again Postponed, to Oct. 30

WASHINGTON — Because of further delay in completing oil hearings before the TNEC, the Department of Justice has announced a second postponement of steel hearings before the committee, this time to Oct. 30.

LINDBERG

HEAT TREATING MAGIC



● It's not sleight of hand, this magic of better heat treating that's being performed so that your products will be stronger, wear longer, look better, and cost less to produce. It's the real magic of hardening atmospheres that prevent your steel from scaling or decarburizing — that brings your springs, stampings and small parts from the quench tank absolutely bright. It's the magic of tempering equipment that speeds your parts up to the exact heat desired — and is so uniform that tolerances of plus or minus 1-point Rockwell "C" can be established and maintained. See this magic in action during your visit to Chicago. Visit the plant of the Lindberg Steel Treating Co., largest commercial steel treating plant in the world. A cordial welcome awaits you.

LINDBERG FURNACES

CYCLONE FOR TEMPERING • HYDRYZING FOR HARDENING

See • *See the combined exhibits of the Lindberg Engineering Co. and Lindberg Steel Treating Co. at the National Metal Show, October 23 to 27, International Amphitheatre, Chicago, Ill.*

Unofficial "Fair Profit" On War Contracts for U.S. Given as 6%

WASHINGTON — Despite the Justice Department's threats of anti-trust action against unwarranted price rises, it has given assurance to the War and Navy departments that full cooperation will be forthcoming in building up the national defense.

This was revealed last week at a meeting of the Army Ordnance Association, at which Frederick H. Payne, of the Greenfield (Mass.) Tap & Die Corp., and vice-president of the association, presided. Brig. Gen. C. T. Harris, Jr., chief of the Army Ordnance Department's Industrial Service, and Col. Harry K. Rutherford, director of the War Department's planning branch, told members of the association, a semi-official organization interested in industrial mobilization, that such word had been passed along to them by Attorney General Murphy.

Discussions on what constitutes a fair profit on war-time contracts brought from General Harris the estimate that 6 per cent represented such a profit but he cautioned against interpreting the estimate as an official one.

Members of the association, including the chiefs of the 14 ordnance districts, their assistants and scores of representative manufacturers from widely scattered sections of the country, also learned that:

1. In the event of war, contracts would be allocated to certain factories already surveyed for their respective capacities to produce the desired materials; and that the established competitive bidding practice would be temporarily discarded and prices and contracts would be made the subject of negotiations.

2. The Ordnance Department is currently facing difficulties in its attempt to place orders with manufacturers under peace-time conditions at home and war-time conditions abroad.

3. That the 8-hr. law would not be permitted to restrict manufacturers during the pressure of war.

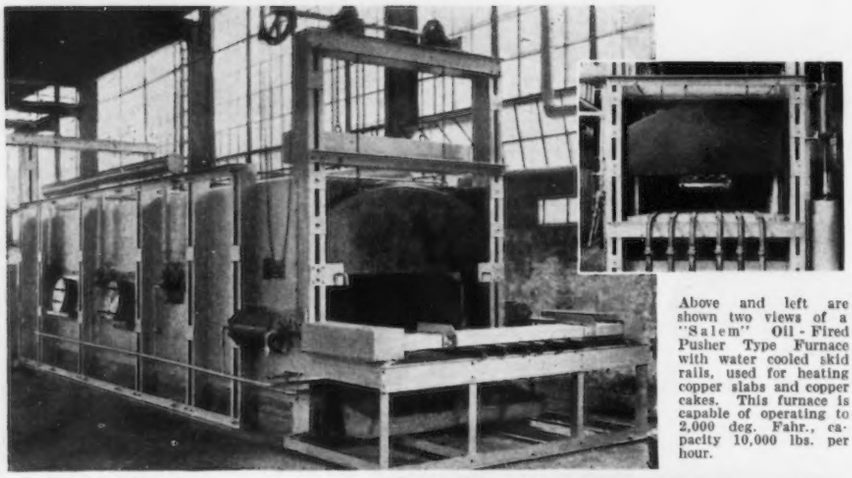
4. War-time contract forms, eliminating many risks to manufacturers, have been prepared but cannot be used under present conditions.

Meanwhile, it was budget time again on the Potomac with the Navy Department sending to the Budget Bureau a record peace-time budget expected to total more than $900,000,000. The final figure is subject to change depending upon subsequent world developments. The Navy received $773,049,151 from Congress last session.

Two More 45,000-Ton Ships

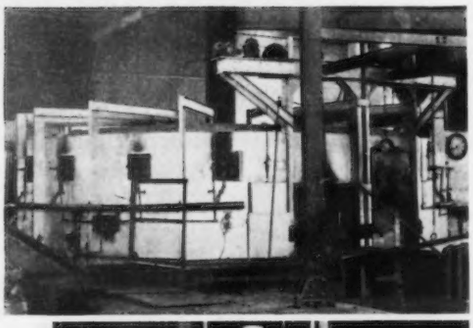
The major item, which may run in the neighborhood of $400,000,000, will be for starting construction on new ships and for continuing construction on ships now building. Appropriated for this purpose last session was $253,604,712. While details of new ships to be built are being withheld there are indications that the construction of two more 45,000-ton battleships, six submarines, six destroyers and eight cruisers, may be under serious consideration. Navy ordnance expenditures may reach $50,000,000 in 1941, as compared with $32,000,000 during the current fiscal year.

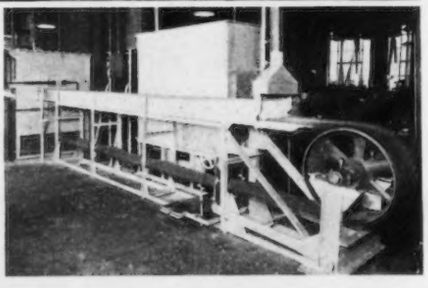
SALEM FURNACES FOR NON-FERROUS METALS



Above and left are shown two views of a "Salem" Oil-Fired Pusher Type Furnace with water cooled skid rails, used for heating copper slabs and copper cakes. This furnace is capable of operating to 2,000 deg. Fahr., capacity 10,000 lbs. per hour.

WITH much specialized training in designing and building of non-ferrous heating and heat treating furnaces "Salem" stands ready to fill your needs. Ask us about your own requirements.





Middle illustration shows a Fuel-Fired Rotary Hearth Furnace used to heat non-ferrous billets for extrusion. This furnace is also used for heating shells. Bottom illustration at the right shows a "Salem" 40 K.W. Special Atmosphere Electric Furnace with wire mesh belt conveyor for brazing firearm components. Material is delivered from furnace in bright condition.

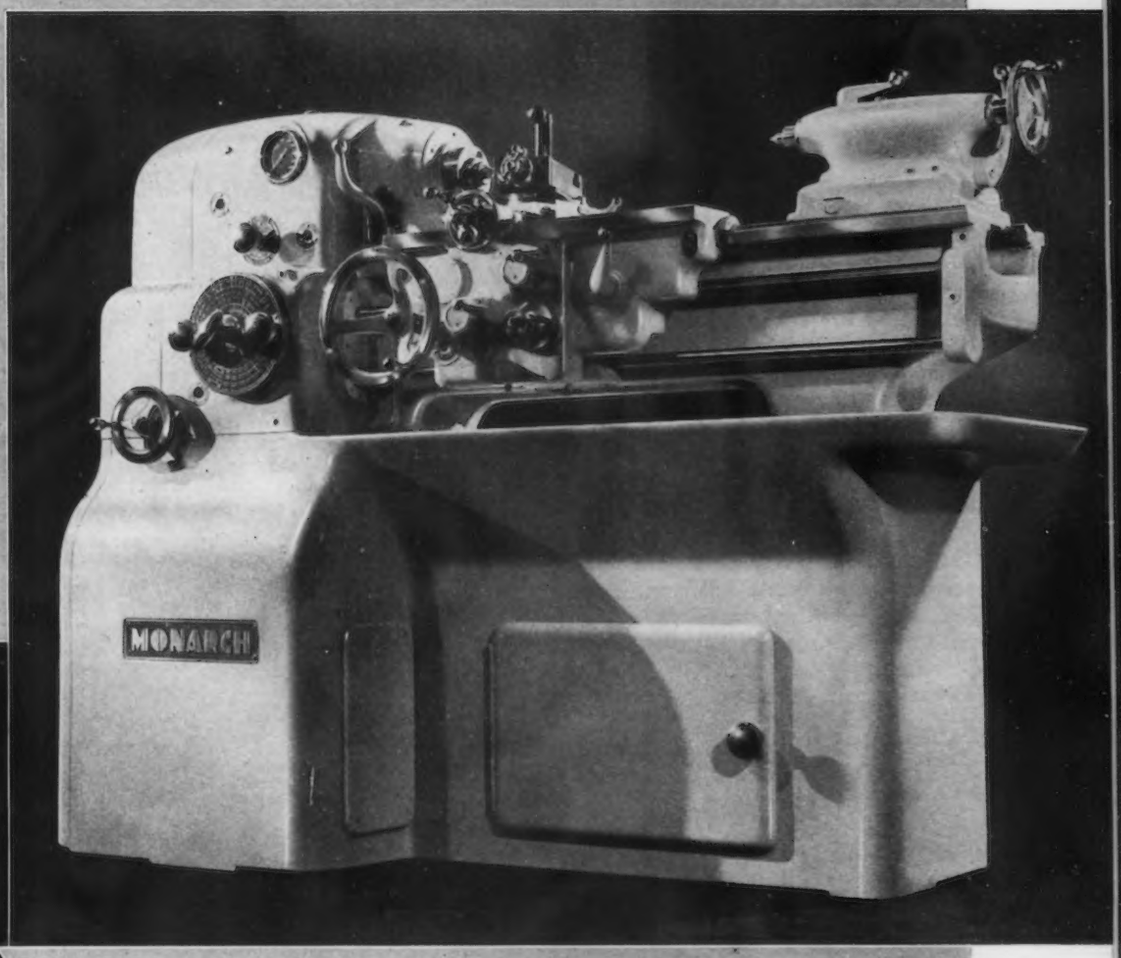
SALEM ENGINEERING COMPANY

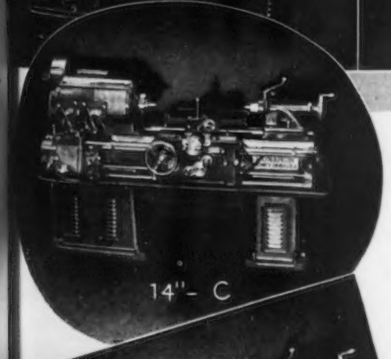
SALEM, OHIO

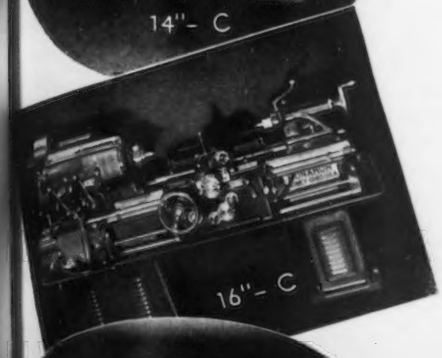
New York — Chicago
Detroit — Pittsburgh
London — Paris
Welland, Ontario

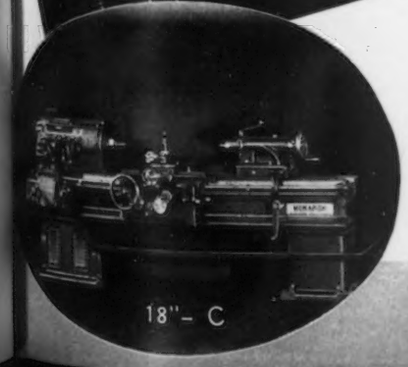
SALEM ENGINEERING COMPANY

THE NEW 10" *Sensitive Precision Lathe* ROUNDS OUT THE MONARCH TOOL-ROOM LATHE LINE









THIS new and most complete streamlined 2. H. P. lathe effectively handles much of the work now being done on 12", 14", and 16" geared-head tool-room lathes. Besides producing such jobs in less time and with greater accuracy, the scientifically arranged controls of this 2000-pound precision machine make a "desk high" working position possible and definitely minimizes operator fatigue.

These illustrations only suggest the extent of the comprehensive line of Monarch tool room lathes. We will welcome an opportunity to make a comparative and competitive presentation.

If It Can Be Turned, Monarch Can Likely Turn It Better and Faster.

THE MONARCH MACHINE TOOL CO., Sidney, Ohio, U.S.A.

MONARCH LATHES
COVER THE TURNING FIELD

Chicago Sales Office: 622 West Washington Boulevard • Indianapolis Sales Office: 3115 North Meridian Street. • Newark Sales Office: 1060 Broad Street • Pittsburgh Sales Office: 604 Chamber of Commerce Building

Agencies in principal industrial centers of this and foreign countries.

MAKE *MORE GOODS FOR MORE PEOPLE* AT FAR LESS COST!

War-Time Exports of Steel and Machine Tools

IN view of widespread interest as to the volume of export business in steel and machine tools that may eventually come to the United States as a result of disruption of normal commerce caused by the European war, THE IRON AGE presents the first of a series of tables (others to appear in later issues) showing the export trade in these products before and during the period of the first World War. The character of the changes that may come during this war will not necessarily be patterned after those of the other war, but the figures of that period possibly give the best obtainable clue as to what trends may develop.

Tables here presented covering iron ore exports (to Canada only), ingots, blooms and billets, pig iron, scrap and metal-working machinery also include export figures for the years 1937 and 1938 for comparison purposes. These data, compiled from reports of the U. S. Department of Commerce, have been limited to the larger importers of American steel and machinery and some of the South American countries. Some nations not included in these tables buy larger quantities of American steel than the South American countries, but in view of the present interest in the countries to the south of us, the figures for those nations are included. Data for 1913 to 1917 are based on fiscal years; those for 1918, 1937 and 1938 are based on calendar years. United Kingdom includes Scotland and Ireland. Owing to minor changes in the Government's method of classifying steel products, figures for 1937 and 1938 are not in all cases exactly comparable to those for the war years.

1940 Catalog and Directory Issued by A.S.M.E.

THE 29th annual A.S.M.E. Mechanical Catalog and Directory, 1940 edition, containing 494 pages, is now being distributed to members of the American Society of Mechanical Engineers. Non-members can obtain copies at $3 each from the headquarters of the society, 29 West 39th Street, New York.

IRON ORE TO CANADA

	1913	1914	1915	1916	1917	1918	1937	1938
Tons	1,221,364	1,004,545	407,026	923,152	1,024,895	1,256,383	1,263,936	491,135
Value	$3,684,233	$3,401,156	$1,277,247	$2,790,498	$3,282,903	$5,535,090	$4,036,242	$1,951,890
Aver. value per ton	$3.02	$3.39	$3.14	$3.02	$3.20	$4.41	$3.19	$3.97

INGOTS, BLOOMS and BILLETS
(Tons)

Exported To	1913	1914	1915	1916	1917	1918	1937	1938
France	.....	.....	2,588	576,109	829,486	680,248	.....	3,157
United Kingdom	152,037	25,280	198,919	240,802	540,965	647,115	70,595	30,771
Canada	78,543	21,646	16,452	92,597	186,272	247,332	8,080	9,769
Italy	.....	.....	.....	49,984	370,745	209,860	.....	.....
Japan	110	.....	32	554	303	287	204,562	91,461
All other	38	.....	2,425	2,051	7,255	1,347	48,271	24,725
Total	230,728	46,926	220,416	962,097	1,935,026	1,786,189	331,508	159,383
Aver. value per ton	$23.12	$22.22	$21.85	$44.08	$70.33	$84.30	$39.36	$36.93

METAL WORKING MACHINERY
(Value in Thousands of Dollars)

Exported To	1913	1914	1915	1916	1917	1918	1937	1938
France	$1,937	$1,772	$8,696	$13,317	$29,254	$15,350	$4,810	$5,702
United Kingdom	3,418	3,179	12,296	20,439	16,300	19,297	19,450	15,232
Italy	438	422	511	4,779	8,771	3,251	1,644	1,170
Germany	3,175	2,167	122	.....	.....	.....	224	1,128
Russia[1]	1,090	1,335	2,489	12,333	15,329	9	6,925	34,691
Canada	2,326	1,199	1,813	6,464	7,780	4,814	7,438	4,968
Japan	120	120	86	437	1,092	4,047	12,125	22,470
Australia	406	1,317	282	800	664	403	1,144	1,750
Argentina	113	110	26	143	155	128	412	415
Brazil	346	116	55	29	55	230	451	572
Chile	44	85	28	58	427	646	111	215
Cuba	125	147	101	152	334	311	107	111
All other	2,559	2,042	1,658	2,364	4,774	3,135	7,931	11,611
Total	$16,097	$14,011	$28,163	$61,315	$84,935	$51,621	$62,772	$100,035

[1] Includes Russia in Asia and in Europe.

PIG IRON
(Tons)

Exported To	1913	1914	1915	1916	1917	1918	1937	1938
France	1,186	503	49	17,244	125,758	8,181	14,229	12,241
United Kingdom	22,576	17,612	40,127	49,191	134,402	73,174	233,218	40,615
Canada	222,184	125,456	38,550	89,805	137,071	118,287	.....	4,759
Austria-Hungary	8,101	2,650	.....	.....	.....	.....	.....	13,825[1]
Italy	19,694	18,201	36,213	105,855	282,991	41,241	10,003	6,672
Germany	.....	.....	.....	.....	.....	.....	20,992	.....
Australia	.....	20,353	6,103	380	230	15	.....	.....
Japan	1,993	1,445	1,843	3,610	8,478	11,986	409,241	316,280
Argentina	170	1,464	730	462	1,940	99	106	.....
Brazil	775	1,080	170	302	2,427	47	5	1
Chile	938	1,465	2,285	5,150	7,892	2,179	2,644	1,426
All other	9,405	11,766	4,524	14,729	133,741	6,682	91,998	37,032
Total	287,022	201,995	130,594	286,728	834,930	261,891	782,436	432,851
Aver. value per ton	$14.43	$14.16	$15.86	$20.39	$29.67	$39.43	$24.80	$16.48

[1] Hungary only.

IRON and STEEL SCRAP
(Tons)

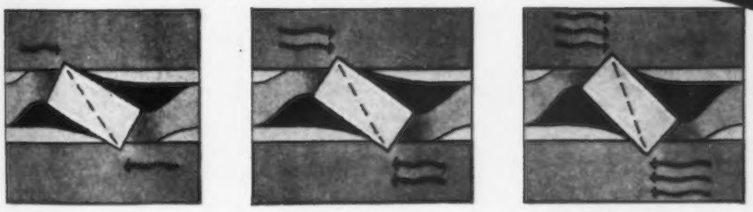
Exported To	1913	1914	1915	1916	1917	1918	1937	1938
France	218	.....	.....	1,229	4,784	.....	3,168	3,348
Italy	25,255	21,537	19,636	129,498	187,528	443	381,394	434,717
United Kingdom	1,109	353	292	1,810	1,998	290	845,216	387,347
Canada	75,467	44,259	8,895	21,484	23,321	1,111	185,566	92,217
Japan	.....	96	2	2,044	15,763	.....	1,904,768	1,381,801
Germany	.....	293	.....	.....	.....	.....	88,153	230,903
Poland and Danzig	.....	.....	.....	.....	.....	.....	275,337	151,451
All others	152	2,744	1,005	1,645	5,272	316	408,988	316,307
Total	102,201	69,282	29,830	157,710	238,666	2,160	4,048,102	2,998,591
Aver. value per ton	$14.05	$12.15	$12.04	$16.08	$20.03	$29.46	$18.91	$16.28

Rough handling in shipping is another reason why every metal product needs the positive protection of

SHAKEPROOF LOCK WASHERS

TRADE MARK

THIS TRIPLE-ACTION-LOCK ACTUALLY HOLDS TIGHTER AS VIBRATION INCREASES!



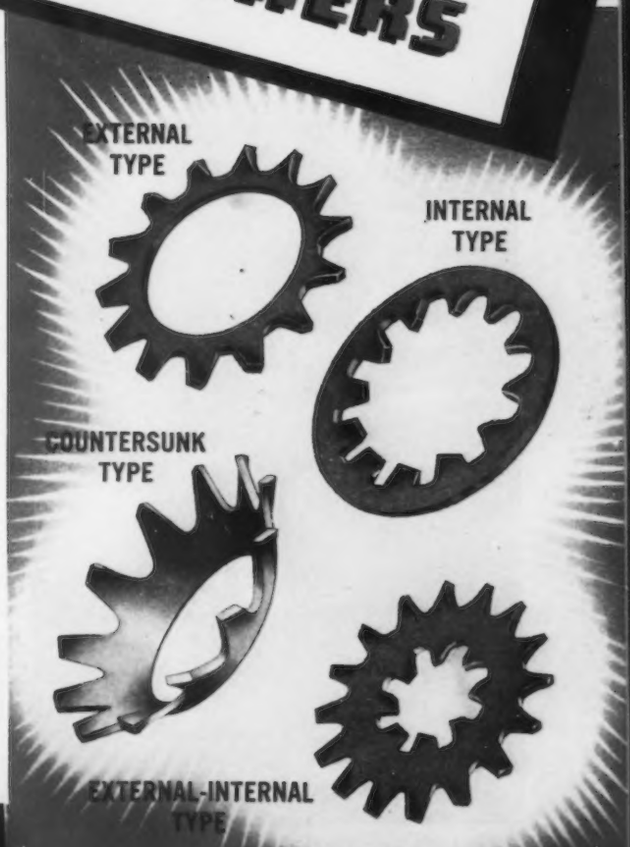
INITIAL LOCK | MEDIUM VIBRATION | INTENSE VIBRATION

When a nut or screw is turned down on a Shakeproof Lock Washer, the tapered, twisted teeth bite into both surfaces forming a powerful strut that resists any backward movement. When vibration occurs, the resulting force combined with the spring-tension and strut-action of the lock washer, makes the teeth bite in deeper, increasing the holding power. The greater the vibration, the deeper the teeth bite and the tighter the screw or nut is locked . . . thus, even intense vibration cannot loosen a part that is protected by Shakeproof Lock Washers!

PROTECTION THAT SAVES MONEY!

Leading metal product manufacturers use Shakeproof Lock Washers by the millions to be certain their products withstand the severe vibration that is certain to be experienced in any form of shipping as well as the vibration that comes with ordinary use. Your products need this protection, too! Write for free testing samples, today!

CARRIED IN STOCK BY LEADING MILL SUPPLY JOBBERS



SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products Manufactured by Illinois Tool Works

Plants at Chicago and Elgin, Illinois — 2525 No. Keeler Avenue, Chicago, Ill.

In Canada: Canada Illinois Tools Ltd., Toronto, Ontario

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"Fastening Headquarters"

SHAKEPROOF

SEMS (Pre-Assembled Shakeproof Lock Washer and Screw)—Thread-Cutting Screws

Self-Locking Set Screws—Locking and Plain Terminals—Spring Washers—Special Stampings

Government Department Concerned Over Walsh-Healey Wage Decision

WASHINGTON — Officials of the Treasury's Procurement Division and the War and Navy Departments who have long considered the Walsh-Healey Public Contracts Act as imposing upon Government contractors restrictions undesirable from an administrative standpoint, are nevertheless concerned over the decision of the Circuit Court of Appeals of the District of Columbia in the steel wage case. The language of the court in raking Secretary of Labor Perkins over the coals for her "arbitrary and unwarranted" action in the steel wage determination was not displeasing to them but the fact that prospective bidders were recognized as having standing in court is the thing that perturbs these officials.

In the words of one Government official, the big three in the field of Government purchase—Procurement, War and Navy—are fearful that the decision, if upheld by the Supreme Court, may mean a series of headaches for purchasing officers because of the possibility that it may give new status to those who heretofore have been regarded as not having any standing in court. The danger, according to these observations, lies in the likelihood that under the ruling prospective bidders, if they protest against rigid specifications or other requirements which they consider to be unfair or unduly restrictive, may come into court seeking relief and tie up an entire purchasing program.

It is argued that to establish such a precedent at this time especially when purchases for national defense requirements are soaring, would be to seriously retard purchasing activity by court injunctions of a type with which the Government has never had to contend before.

This may have been what Associate Justice Henry White Edgerton had in mind in his minority decision when he wrote that suits like the steel wage action "operate to disturb the whole contracting system of the Government," and added:

"A judgment or decree in favor of the appellants (Lukens Steel Co., and the six other independent steel mills in the East) will control the terms on which the United States may enter into contracts for the necessary work of the Departments of Labor, War, Navy, the Treasury, the Interior, and the Post Office.

"It will therefore regulate the conduct by the United States of vast activities of unquestioned constitutionality and legality. Although it will not prevent those contracts from being made and those activities from being carried on, it will prevent them from being made and carried on on certain terms. It will have a far larger effect upon the United States than the decree which was sought and refused in Wells v. Roper . . . for that decree would have controlled only a single contract."

In that case, action was brought against the United States after the Government had declined to deal contractually with the plaintiff company, to whom the Government had awarded a contract.

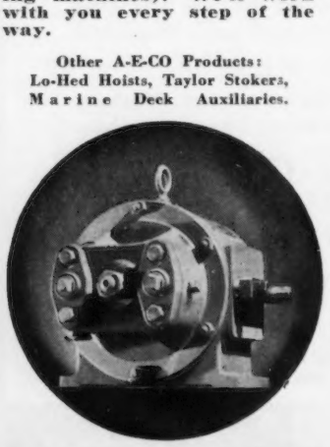
The question of whether the steel

CUSHIONING EFFECT

HELE-SHAW
Fluid Power
HAS IT!

What a catcher's mitt does to absorb the thumping of a baseball well illustrates the cushioning effect of Hele-Shaw Fluid Power on machine drives. The oil used as the Fluid Power medium in Hele-Shaw Pumps is in itself a shock absorber. Excess shocks are readily relieved through valves, saving your equipment from undue stresses and strains or possible breakage. Before you design, build or buy machinery, see if you can't prolong its life and save money by driving with Hele-Shaw Pumps. Also ask us about the many other practical, usable benefits of Hele-Shaw Pumps and Fluid Power. (Oil under pressure for driving machines). We'll work with you every step of the way.

Other A-E-CO Products:
Lo-Hed Hoists, Taylor Stokers,
Marine Deck Auxiliaries.



A-E-CO Hele-Shaw FLUID POWER

AMERICAN ENGINEERING COMPANY

2410 ARAMINGO AVENUE, PHILADELPHIA, PA.

companies had any standing in court because of their status as mere prospective bidders was raised immediately when action was first brought against the Labor Department. Prior to that the paramount question involved was how the companies could get their case into court. Many observers, basing their arguments on that score, had forecast that it was highly doubtful that the Secretary of Labor's steel wage determination would be challenged in the courts.

On this question, the minority decision said that it knew of no case in which it had been held that the courts could, without Congressional authorization, inquire whether officers of the Government were exceeding their authority when "the only threatened damage consists in the loss of an opportunity to make money by dealing with the Government."

Justice Edgerton called the injury anticipated by the steel companies "too contingent to qualify as irreparable injury and support an injunction."

Referring further to the steel companies involved, the minority opinion had this to say:

"They may not bid, may not be the lowest bidders if they do, may not be awarded a contract if they are the lowest bidders, and may not profit from a contract if they get one."

The majority decision written by Associate Justice Justin Miller said, however, that "the right to carry on business, generally, necessarily includes the right to negotiate with prospective customers and purchasers free from unlawful restrictions and interference."

"In this respect it is immaterial whether the prospective customer be a private individual or a Government agency," the majority opinion declared. "In fact, the right of a person to bid on Government contracts is a more valuable right—because of the policy adopted by Congress to encourage free and full competition—than is his right to seek the patronage of private individuals . . ."

The majority decision conceded that a citizen need not bid on Government contracts but pointed out that a person who does bid can be subjected to lawful limitations imposed by Congress.

"But when any person, private or official, attempts to interfere with these rights by unlawful limitations not imposed or allowed to be imposed by Congress, then relief may be obtained upon a proper showing," the majority said.

What the decision portends for Government purchasing policies in the future legalites in the various Government agencies is not certain, but representatives of the War and Navy Departments and the Procurement Division, are watching developments closely. Previously, although they were named as parties to the suit, they had been only mildly interested and there were signs that they were not displeased to see Madam Perkins' authority contested in court. Now, however, they apparently plan to actively participate in the proceedings.

Meehanite Institute Meeting in Detrot Nov. 1-3

MEEHANITE RESEARCH INSTITUTE OF AMERICA, INC., Pittsburgh, will hold its annual meeting in Detroit Nov. 1, 2, and 3. More than 50 papers describing results of research conducted by members on all phases of foundry practice and applications of Meehanite castings will be presented. About 100 representatives of member companies from the United States, Canada, and Australia will attend.

TO PREVENT CONTACT—
STEEL PICKS PENOLA
IN the grueling operation of a steel mill lubricants *must not fail.* It is their vital duty to prevent the costly metal-to-metal contact that ruins bearings and ties up production.
For jobs like this steel men pick Penola. Proof is the fact that more Penola steel mill lubricants are sold than any other make in the world. The roll neck bearings of over 80% of all 4-high mills are Penola-lubricated.
Penola steel mill lubricants are designed to give sure protection under *any* conditions. Let Penola's lubrication engineers help *you* beat friction . . . protect equipment . . . and save money.
PENOLA LUBRICANTS
Penola Inc., Pittsburgh, Pa.
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New York • Chicago • Detroit
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LUBRICANTS FOR THE STEEL INDUSTRY SINCE 1885

$8,710,000 Rifle Order Goes to Winchester Repeating Arms Co.

WASHINGTON—A $8,710,000 contract awarded the Winchester Repeating Arms Co., New Haven, Conn., for 65,000 Garand semi-automatic rifles, led a list of awards totaling $15,147,818 announced last week by the War Department's Ordnance Division.

Awards under the artillery ammunition program went to these companies: Scovill Mfg. Co., Waterbury, Conn., ammunition parts, $302,937; Falls Stamping & Welding Co., Cuyahoga Falls, Ohio, shipping band assemblies for ammunition, $7,489; Martin-Parry Corp., York, Pa., ammunition parts, $10,232; Madison Kipp Corp., Madison, Wis., ammunition parts, $1,244; Bethlehem Steel Co., Bethlehem, Pa., ammunition parts, $2,667,924.

These companies received contracts under the artillery material program: Bausch & Lomb Optical Co., Rochester, N. Y., sighting equipment, $92,494; sterescopic trainers, $76,068; A. B. Farquhar Co., Ltd., York, Pa., guns with mounts, $128,975; General Electric Co., Schenectady, N. Y., $210,070.

Contract to Allis-Chalmers

The Allis-Chalmers Co., Milwaukee, received a $61,825 contract for tractor cranes under the automotive material program.

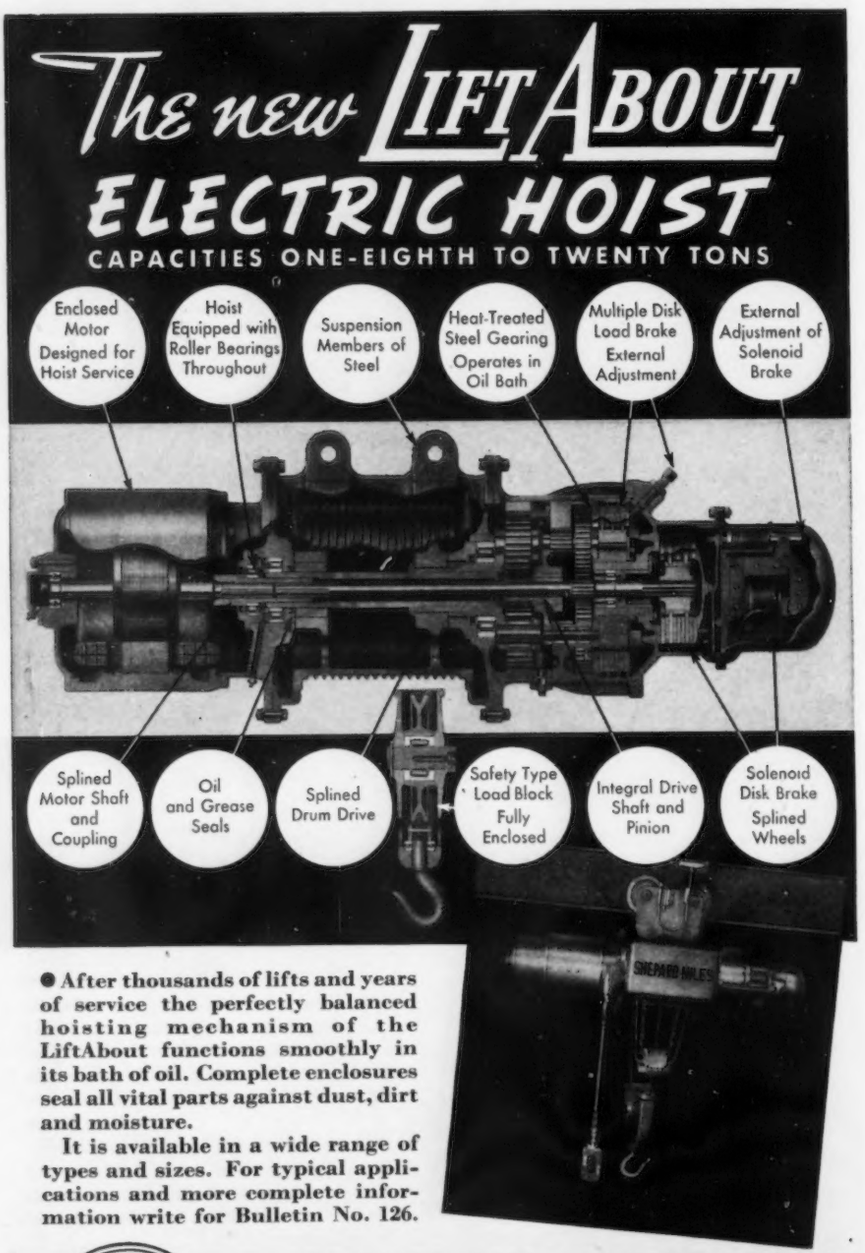
In addition to the $8,710,000 contract awarded the Winchester Repeating Arms Co., the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., was awarded a $166,561 contract for pistols with spare parts and parts for revolvers; Smith & Wesson Co., Springfield, Mass., received a $92,588 contract for parts for revolvers; and Cowdrey & Co., Inc., New York City, a $2,175 contract for shotguns.

Awards under the rehabilitation machinery program went to: Gallmeyer & Livingston Co., Grand Rapids, Mich.,, grinding machines, $7,653; Brown & Sharpe Mfg. Co., Providence, R. I., grinding machines, $31,354; Cincinnati Milling Machine, Inc., Cincinnati, tool and cutter grinders, $9,335; Cincinnati Grinders, Inc., Cincinnati, milling machines, $7,975; Leeds & Northrop Co., Philadelphia, electric furnaces, $2,971; William S. Doig, Inc., Brooklyn, mailing machines, $3,925; H. F. Allen Co., Inc., New York City, job of rebuilding and modernizing shaper, $3,086; grinding machines, $13,986; Consolidated Machine Tool Co., Rochester, N. Y., vertical boring mill, $174,825; Pratt & Whitney, Hartford, Conn., vertical shaper, $6,350; Giebel Machine Tool Co., Inc., New York City, cut-off saw machine, $2,107; and the Kearney & Trecker Corp., Milwaukee, Wis., milling machines, $9,495.

Special Machinery Awards

These companies were awarded contracts under the special machinery program:

Fidelity Machine Co., Philadelphia, trimming machinery, $8,975; Lloyd & Arms, Inc., Philadelphia, charging machines, $12,500; vertical presses, $7,425; E. W. Bliss Co., Brooklyn, vertical duplex press, $14,925; Standard Machinery Co., Providence, R. I., vertical press, $1,390; Waterbury Far-


The new LIFT ABOUT
ELECTRIC HOIST
CAPACITIES ONE-EIGHTH TO TWENTY TONS
Enclosed Motor Designed for Hoist Service
Hoist Equipped with Roller Bearings Throughout
Suspension Members of Steel
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Splined Drum Drive
Safety Type Load Block Fully Enclosed
Integral Drive Shaft and Pinion
Solenoid Disk Brake Splined Wheels
SHEPARD NILES

● After thousands of lifts and years of service the perfectly balanced hoisting mechanism of the LiftAbout functions smoothly in its bath of oil. Complete enclosures seal all vital parts against dust, dirt and moisture.

It is available in a wide range of types and sizes. For typical applications and more complete information write for Bulletin No. 126.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

356 SCHUYLER AVENUE... MONTOUR FALLS, N. Y.

rel Foundry & Machine Co., Waterbury, Conn., vertical press, $3,700; gaging and weighing machine, $6,500; Ferracute Machine Co., Bridgeton, N. J., vertical presses, $4,388; horizontal presses, $28,265; and the Lindberg Engineering Co., Chicago, annealing furnaces, $22,900.

H. E. Dickerman Mfg. Co., Springfield, Mass., was awarded a $1,603 contract for gages under the inspection gages program.

Air Corps awards totaling $1,169,515 went to these companies:

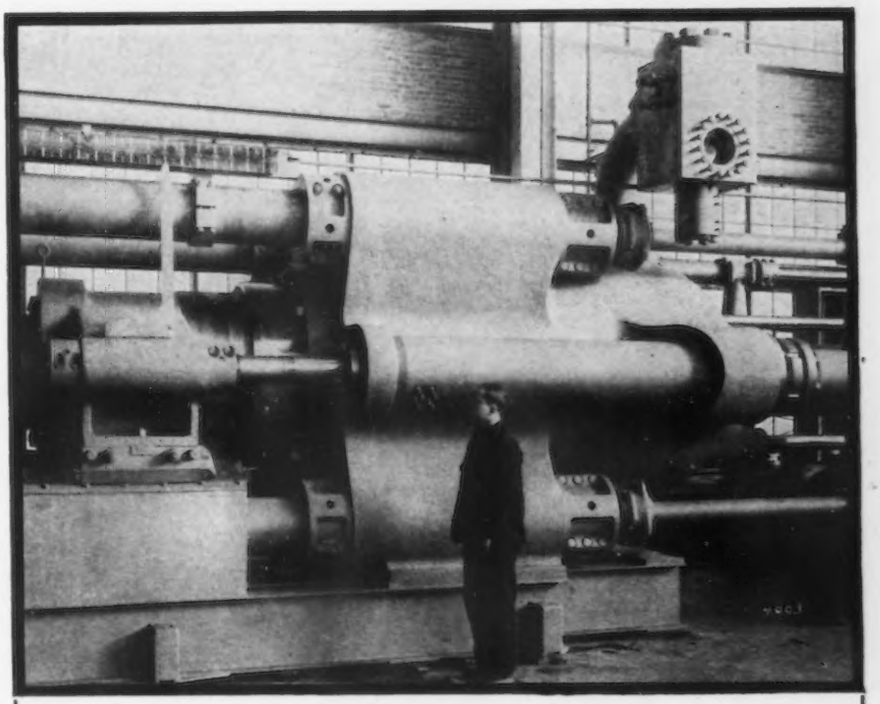
United Aircraft Corp., Hamilton Standard Propeller Division, East Hartford, Conn., propeller and control assemblies, $964,596; Goodyear Tire & Rubber Co., Inc., Akron, Ohio, wheel and brake assemblies, $98,235; and the Seversky Aircraft Corp., Farmingdale, Long Island, N. Y., spare parts for planes, $51,683.

Government Steel Orders

WASHINGTON — Government purchases of iron and steel products, as reported by the Labor Department's Public Contracts Division for the week ended Oct. 7, totaled $2,663,044. Reported for the same period were contracts aggregating $938,307 for non-ferrous metals and alloys and $667,573 for machinery. Details follow:

Iron and Steel Products

Lansdowne Steel & Iron Co., Morton, Pa., Navy S & A, steel forgings	$11,122.50
Bethlehem Steel Co., Bethlehem, Pa., War Ordnance, steel forgings	61,333.00
Poor & Co., Canton Forge & Axle Works, Canton, Ohio, War Ordnance, drop forgings	10,356.20
Bethlehem Steel Co., Inc., Bethlehem, Pa., War Ordnance, die forgings	32,800.00
R. Wallace & Sons Mfg. Co., Wallingford, Conn., C C C War, steel tableware	33,625.00
United States Pipe & Foundry Co., Philadelphia, Panama Canal, water pipe	17,350.00
Lynchburg Foundry Co., Lynchburg, Va., Interior, cast-iron pipe	15,213.00
Caterpillar Tractor Co., Peoria, Ill., War Q M C, Tractor	17,779.00
Phillips & Buttorff Mfg. Co., Nashville, Tenn., C C C War, heating stoves	61,597.10
Hart Mfg. Co., Louisville, Ky., C C C War, Army range	15,107.50
Bethlehem Steel Co., Bethlehem, Pa., War Engineer, fabricated steel and piling	74,330.60
Butler Mfg. Co., Kansas City, Mo., and Galesburg, Ill., Agriculture, steel grain bins	807,660.00
A. N. Eaton Metal Products, Omaha, Agriculture, steel grain bins	80,106.00
Stearns Roger Mfg. Co., Denver, Colo., Interior, pier grating	11,101.00
Butler Mfg. Co., Kansas City, Mo., Agriculture, steel grain bins	172,670.00
A. N. Eaton Metal Products, Omaha, Agriculture, steel grain bins	23,660.00
Kilby Steel Co., Anniston, Ala., Agriculture, steel grain bins	178,220.00
The Sioux Steel Co., Sioux Falls, S. D., Agriculture, steel grain bins	165,370.00
Bethlehem Steel Co., Los Angeles, War Engineer, steel sheet piling	58,590.00
Stearns-Roger Mfg. Co., Denver, Interior, cylinder gate	16,988.00
Aerial Machine & Tool Corp., New York City, War Air Corps, special tools	11,361.83
Kay Products Co., Detroit, War Air Corps, special tools	11,486.50
Equitable Equipment Co., Inc., New Orleans, War Engineer, wire rope	15,442.78
Herring Hall Marvin Safe Co., Hamilton, Ohio, Navy S & A, safes	12,820.00
Lansdowne Steel & Iron Co., Morton, Pa., War Ordnance, projectiles	17,520.00
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., War Ordnance, pistol parts	42,059.00
War Ordnance ,revolver parts	57,130.00
Smith & Wesson, Inc., Springfield, Mass., War Ordnance, revolver parts	92,588.00
A. B. Farquhar Co., Ltd., York, Pa., War Ordnance, mortars & mounts	128,459.10
National Pneumatic Co., Inc., New York City, War Ordnance, gun barrels	27,169.00
Truscon Steel Co., Cleveland, War Engineer, wire rope clips	11,655.00
R. L. Rettew & Co., Lebanon, Pa., War Ordnance, lifting plugs	51,968.40
The Dicke Tool Co., Inc., Down-	



HYDRAULIC PRESSES

EXTRUSION PLANTS

PUMPS and ACCUMULATORS

MODERNIZATION OF HYDRAULIC PLANTS

SCHLOEMANN

ENGINEERING CORP. PITTSBURGH, PA.

Rolling Mill Machinery Hydraulic Presses

ers Grove, Ill., War Signal Corps, reel cart 19,868.85
Edgcomb Steel Co., Philadelphia, War Ordnance, steel 88,467.28
General Electric Co., Schenectady, N. Y., and Erie, Pa., War Ordnance, Howitzers 210,070.00

Non-Ferrous Metals and Alloys

American Brass Co., Waterbury, and Torrington, Conn., War Ordnance, cartridge brass disks.... $39,070.00
Scovill Mfg. Co., Waterbury, Conn., War Ordnance, cartridge cases.. 297,304.90
Revere Copper & Brass, Inc., Baltimore, War Ordnance, cartridge disks 114,715.00
American Brass Co., Waterbury, Conn., War Ordnance, cartridge cups 26,850.00
Phelps-Dodge Refining Corp., New York City, Treasury, electrolytic copper 12,050.00
Metal & Ore Corp., New York City, Navy S & A, tungsten ore 438,000.00
American Metal Crafts Co., Attleboro, Mass., War Q M C, insignia 10,317.50
Sullivan Machinery Co., Michigan City, Ind., Navy S & A, air compressors 11,919.80
Hendey Machine Co., Torrington, Conn., Navy S & A, lathes..... 14,606.00
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., War Ordnance, vertical presses 27,750.00
Henry Prentiss & Co., Inc., New York City, War Ordnance, grinding machines 13,986.00
Pratt & Whitney Division Niles-Bement - Pond Co., Hartford, Conn., War Ordnance, gun drilling machines 24,718.00
William Sellers & Co., Inc., Philadelphia, War Ordnance, boring machines 44,204.00
Henry Prentiss & Co., Inc., New York City, War Ordnance, boring machines 88,369.25
Boye & Emmes Machine Tool Co., Cincinnati, Navy S & A, engine lathe 11,053.00
Henry Prentiss & Co., Inc., New York City, War Ordnance, milling machine 40,575.00
International Postal Supply Co., Brooklyn, Post Office, canceling machines 17,080.00
American Checkwriter Co., Washington, Procurement, check-writing machines ..... Indefinite
Northwest Engineering Co., Chicago, T V A, shovel 15,000.00
Northwest Engineering Co., Chicago, T V A, shovel 16,150.00
Kidder Press Corp., Inc., Dover, N. H., G P O, printing press.... 73,134.00
Aldrich Pump Co., Allentown, Pa., Navy S & A, pumps 12,446.00
York Ice Machinery Corp., Philadelphia, York, Pa., and Canton, Ohio, Navy S & A, refrigerating plants 25,434.12
Good Roads Machinery Co., of N. Y., Inc., New York City, W P A, tandem rollers 11,592.00
McKiernan-Terry Corp., Harrison, N. J., Navy S & A, windlasses.. 24,878.00
Clyde Iron Works, Inc., Duluth, Minn., War Engineer, steam capstans 12,240.00
Industrial Brownhoist Corp., Bay City, Mich., Panama Canal, locomotive cranes 47,400.00
Coulter & McKenzie Machine Co., Bridgeport, Conn., War Ordnance, pickling machines 29,250.00
Crane Co., Chicago, Ill., Navy S & A, steel valves 17,984.50
Jenkins Brothers, Bridgeport, Conn., Panama Canal, gate valves 38,815.00
T. L. Smith Co., Milwaukee, Wis., T V A, concrete mixers 15,717.00
Wilson-Weesner-Wilkinson, Knoxville T V A, concrete mixers.... 23,025.00
Blaw-Knox Division Blaw-Knox Co., Pittsburgh, Panama Canal, batching plants 10,246.89

Safe and Sure

The BRASSERT Blast Furnace CINDER NOTCH STOPPER

Advantages of the

BRASSERT CINDER NOTCH STOPPER

- Assures Operator's Safety
- Positive and Powerful Action
- Adjustable Stroke and Pressure
- Low First Cost
- Simplified Operation
- Rugged Construction
- Positive, Straight-Line Motion in opening or closing
- Air or Motor Operated

PLANT engineers and operating men have been quick to appraise the improved safety and power features of the Brassert blast furnace Cinder Notch Stopper.

They have demonstrated that this carefully-designed mechanism materially contributes to better furnace operation, reducing accident risk and effectively performing its function at low cost.

For complete information on the Brassert Cinder Notch Stopper, address our Chicago or Pittsburgh offices. Ask for Bulletin K.

H. A. BRASSERT & COMPANY

ENGINEERS AND CONTRACTORS FOR THE IRON & STEEL INDUSTRY

310 South Michigan Avenue, CHICAGO, ILLINOIS

436 Seventh Avenue, PITTSBURGH, PENNA.

Labor Board Rulings

WASHINGTON — The National Labor Relations Board last week removed from the ballot for the forthcoming election for employees of the Toledo Steel Tube Co., Toledo, the name of the AFL's United Automobile Workers of America. The AFL union requested its name be dropped. Employees in the production unit will now vote for the CIO's Automobile workers union while tool and die makers will vote for the Mechanics Educational Society of America, for the CIO's automobile workers union, or for neither.

Another collective bargaining election involving the AFL-CIO automobile unions has been called for employees of the City Auto Stamping Co., Toledo. The NLRB also has dismissed a petition for investigation and certification of representatives filed by the G. E. Industrial Union on behalf of employees of the General Electric Co., Bridgeport, Conn., insisting that the CIO's electrical and machine workers union had been duly designated the exclusive bargaining agent for employees.

. . . PERSONALS . . .

GEORGE L. ABBOTT, heretofore vice-president of C. C. and Julian Alexander, with which he was identified for 25 years, has been appointed vice-president and general sales manager of the Graton & Knight Co., Worcester, Mass. He has had a long experience in the tanning and belting industry and is vice-president of the American Leather Belting Association and chairman of the exhibitors committee of the American Supply and Machinery Manufacturers Association.

GEORGE L. ABBOTT

H. G. WALTER, former vice-president of the Gerrard Co., Inc., Chicago, has been elected president. Mr. Walter, a native Chicagoan, has been with the Gerrard Co. some 13 years, serving first as secretary and then vice-president. ADOLF LARSEN, general sales manager, has been elected vice-president in charge of sales.

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HAROLD G. WOLFRAM, for the past 15 years identified with the Porcelain Enamel & Mfg. Co., Baltimore, as laboratory technician, director of research and more recently as factory manager, has been appointed vice-president of the company. He will have charge of all engineering and technical activities of the company.

G. J. BUCKNER, heretofore superintendent of forges and heat treatment division of Bethlehem Steel Co., Bethlehem plant, has been promoted to superintendent of the foundry, forge shop and treatment divisions. C. A. BEVER, superintendent of roll and steel foundries, becomes superintendent of foundries, including roll, steel, brass, iron and ingot mold and also the pattern shop. J. J. COFFEY, formerly superintendent of foundry and shops, becomes superintendent of shops, including shops Nos. 2, 3, 6, 8 and the central tool department. I. S. REITER has been promoted from superintendent of the drop forge department to superintendent of forges and heat treatment division, including press and hammer forge, drop forge, forge specialty and treatment departments. N. E. GRETH, formerly assistant superintendent of

Jacobs Aircraft Engine Co., Pottstown, Pa. save 15% on this accurate work . . .

Here's another example of the Super-Service Radial's ability to produce more work and better work at less cost.

Aeroplane parts such as the crank case shown here are drilled, bored tapped and faced to accurate tolerances of ± .001".

For interchangeable manufacture and the full efficiency of rapid production jigs, you need the convenience and finger-tip ease of handling which the High Speed Super-Service Radial provides.

Bulletin R-21A explains the distinctive high production features of this machine.

Write for your copy today.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

roll and steel foundry, becomes superintendent of roll and steel foundry. ROBERT LATHAM, former foreman in the iron foundry, has been made superintendent of that department, succeeding J. T. MITCHELL, who has retired. M. G. SMITH has been promoted from master mechanic of the drop forge department, to superintendent of that department.

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J. A. BOUFFARD, since 1935 sales manager of the Hamilton Coke & Iron Co., Hamilton, Ohio, has been appointed assistant sales manager of the Milwaukee Coke & Gas Co. Prior to joining Hamilton, Mr. Bouffard had been associated with the Chicago By-Products Coke Co.

❖ ❖ ❖

GEORGE M. BUENZLI, Wisconsin securities division counsel, Madison, Wis., has resigned his position to become general manager and counsel for the Wisconsin Foundry & Machine Co., a position held by his father, the late A. J. Buenzli, for 26 years prior to his death a year ago in January.

❖ ❖ ❖

O. W. EARL was recently made general sales manager, Mullins Mfg. Co., Salem, Ohio. He was formerly assistant general sales manager and previous to that was sales manager of the washing machine parts division and general line stamping division. Mr. Earl has been with the Mullins company for the past 13 years and prior to his association with this company he was connected with the automatic stamping operations at the Chrysler Corp.

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ROBERT F. BLAIR has joined the advertising staff of THE IRON AGE and will be associated with the Cleveland manager, EMERSON FINDLEY. Mr. Blair has had considerable experience in national merchandising. For two years following his graduation from Yale he was in the market survey department of Fuller & Smith & Ross, and later became head of the media department of that organization.

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STUART J. SWENSSON, secretary, American Hot Dip Galvanizers' Association, Pittsburgh, has been elected to the board of directors of the American Trade Association Executives.

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FRANK H. ADAMS, vice-president and general manager of the Surface Combustion Corp., has been named president of the Association of Gas Appliance and Equipment Manufacturers.

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WARREN H. SMITH, formerly associated with the E. I. DuPont de Nemours & Co., Wilmington, Del., has been appointed architectural and consulting engineering representative for the Sherwin-Williams Co., New York.

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FRANCIS G. COLLURA has been appointed Eastern design director for Designers for Industry, Inc., New York.

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JULIUS KAHN has retired as vice-president of Republic Steel Corp., effective Oct. 1. Mr. Kahn joined the Republic organization following the acquisition of Truscon Steel Co. by Republic and has been in charge of product development.

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O. N. LINDAHL, controller, Universal Atlas Cement Co., United States

These Plants **CLEAN FORGINGS** *by* **WHEELABRATING** **— THE AIRLESS ABRASIVE BLASTING PROCESS**

Cleaning Forged Transmission Parts In a 36" x 42" WHEELABRATOR Tumblast.

The fact that prominent plants like these (a partial list) have turned to WHEELABRATING within the last five years is indicative of the merit of this metal cleaning and finishing process.

Cleveland Hardware & Forging Co.	Cleveland, Ohio
Alliance Drop Forging Co.	Alliance, Ohio
Stanley Rule & Level Co.	Newark, N. J.
Dodge Forge Plant	Detroit, Mich.
Thomson Products, Inc.	Detroit, Mich.
Yale & Towne Mfg. Co.	Stamford, Conn.
Cutler-Hammer, Inc.	Milwaukee, Wis.
Hyatt Bearings Div.	Harrison, N. J.
Perfection Tool & Heat Treating	Chicago, Ill.
Great Lakes Forge	Chicago, Ill.
Chrysler Corp.	Kokomo, Ind.
Bridgeport Hardware Co.	Bridgeport, Conn.
Allis-Chalmers Mfg. Co.	LaPorte, Ind.
Timken Detroit Axle Co.	Detroit, Mich.
Springfield Armory	Springfield, Mass.
International Harvester Co.	Milwaukee, Wis.
Herbrand Corp.	Fremont, Ohio
Pittsburgh Forgings Co.	Jackson, Mich.
Wehr Steel Co.	Milwaukee, Wis.
Union Switch & Signal Co.	Swissvale, Pa.
Forgings & Stampings, Inc.	Rockford, Ill.
American Steel Foundries	Hammond, Ind.
Muncie Products Div.	Muncie, Ind.
General Electric Co.	West Lynn, Mass.
Buick Forge Div.	Flint, Mich.
Melling Forging Co.	Lansing, Mich.
Plomb Tool Co.	Los Angeles, Cal.
Union Forging Co.	Endicott, N. Y.
Rockford Drop Forge Co.	Rockford, Ill.
American Forge Div.	Chicago, Ill.
Modern Die & Drop Forge Co.	Blue Island, Ill.
Crescent Tool Co.	Jamestown, N. Y.
Mechanics Universal Joint Div.	Rockford, Ill.
Ashtabula Bow Socket Co.	Ashtabula, Ohio
Gemmer Mfg. Co.	Detroit, Mich.
Timken Roller Bearing Co.	Columbus, Ohio
Utica Drop Forge Co.	Utica, N. Y.
Burgess-Norton, Inc.	Geneva, Ill.
McKaig-Hatch, Inc.	Buffalo, N. Y.
American Fork & Hoe Co.	Geneva, Ohio
Chevrolet-Flint	Flint, Mich.
J. P. Danielson Co.	Jamestown, N. Y.
Reed Roller Bit Co.	Houston, Texas
Olds Motor Works	Lansing, Mich.
Morse Chain Div.	Detroit, Mich.
Vincent Steel Process Co.	Detroit, Mich.
Atlas Drop Forge Co.	Lansing, Mich.
Billings, Spencer Corp.	Hartford, Conn.
Chevrolet Forge Div.	Detroit, Mich.
Cleveland Wire Spring Co.	Cleveland, Ohio
Warner Gear Div.	Muncie, Ind.
Wyman-Gordon Co.	Worcester, Mass.
Peck, Stow & Wilcox Co.	Southington, Conn.
Nash-Kelvinator Corp.	Kenosha, Wis.
Chevrolet Parts Mfg. Co.	Saginaw, Mich.
Bethlehem Steel Co.	Bethlehem, Pa.
Wright Aeronautical Corp.	Paterson, N. J.
Moore Drop Forging Co.	Several Places
Champion DeArment Tool Co.	Meadville, Pa.
Federal Drop Forge Co.	Lansing, Mich.

THE *American* FOUNDRY EQUIPMENT CO. 510 S. BYRKIT ST. MISHAWAKA, IND.

Steel Corp. subsidiary, was elected president of the Controllers Institute of America at the institute's annual meeting in New York, Oct. 9 and 10. Mr. Lindahl, who had previously served as a member of the Chicago Control and as vice-president and a director, addressed the institute's annual general session Oct. 10.

. . . OBITUARY . . .

WALTER H. COCHRAN, a manufacturers' agent in Detroit, where he had lived for 38 years, was buried Oct. 14. Mr. Cochran was born in Muttonville, N. Y.

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MAX. H. BERNSTEIN, who retired three years ago as owner of the Windsor (Ont.) Brass Foundry, died Oct. 11 at the age of 82. He was born in Lithuania.

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CLEMENT C. RICHARD, organizer with his brothers of the Richard Brothers Die Works, Detroit, in 1915, was buried Oct. 12. Mr. Richard was born in 1889 in West Jefferson, Ohio, and spent his early years at Niles, Mich. He served an enlistment in the Navy and went to Detroit in 1911. His brothers, Clarence A. and Otis K., assisted in organization of the die works which in 1928 became the principal unit of the Allied Products Corp. Mr. Richard was elected president of the corporation in 1933.

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J. EDWARD ROE, one of the group which conceived the idea of the Reo Motor Car Co., died Oct. 9 at the age of 77. Mr. Roe was a director and one of the founders of the American State Savings Bank at Lansing, Mich., and had played an active part in the industrial development of the city.

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FRED G. WEBER, vice-president and treasurer, Gregerson Mfg. Co., patternmaker, Milwaukee, died at his home Oct. 7 following a heart attack. He had been associated with the firm for about 10 years. He was 49 years old.

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JOSEPH F. ROTHE, 79, dean of Wisconsin foundrymen, and founder-president of the Joseph F. Rothe Foundry Co., at Green Bay, Wis., died Oct. 6 following an extended illness. He had been a lifelong resident of Green Bay, starting in the business as an apprentice at the East River foundry in 1876. Seven years later he rented a small shop and started his own foundry, which in 1909 was incorporated and at present is one of the largest in the northwest. He was a member of the American Foundry association, and the Fox River Valley Foundry Association. Two sons, Joseph, Jr., and John, were associated with him in the foundry.

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ARCHIBALD F. RADER, president of the Belmont Iron Works, Philadelphia, died at his home in Haverford after an illness of three weeks on Oct. 8, aged 67 years.

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HENRY ALLEN, maintenance superintendent of the Campbell, Wyant & Cannon Co., Lansing, Mich., died of a heart attack, Oct. 8, at Muskegon Heights.

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HARRY M. STERNFELS, a mechanical engineer for General Motors Corp., Detroit, died Oct. 8, aged 49 years.

Modernize With DINGS

THE MOST POWERFUL MAGNETIC PULLEY ON THE MARKET!

TODAY, magnetic separators are better than ever before. Dings has pioneered developments in recent years which make possible their claim "most powerful magnetic pulley on the market, size for size." Bronze spacer rings are an exclusive feature of Dings Pulleys. (See what this means—make the test shown.) Dings pulleys have more heat radiating surface than other pulleys — corrugated radial openings — longitudinal openings — an impeller hub design. These features mean cooler operation, more powerful operation. (A hot separator won't separate.)

And this is just one of many modern Dings Separators for removing iron from foundry sand or for separating ferrous and non-ferrous metals.

If you've been getting along without separators or with old units which may be obsolete when compared with new Dings machines, find out what advantages Dings may bring you. Write for complete information.

DINGS MAGNETIC SEPARATOR CO.

727 Smith St. Milwaukee, Wisc.

Suspend a steel screw from string attached to support. Place steel spacer piece across pole ends of ordinary magnet — bronze or brass spacer across ends of similar magnet. With screw in center, move magnets toward each other at equal rate of motion.

Snap! Screw will jump and be firmly held at the bronze or brass spacer. Steel spacers short circuit magnetic lines of force—weaken the magnetic pull. Bronze spacers preserve magnetic strength—assure a stronger pull.

Bronze spacer rings are standard in Dings separators—other manufacturers use steel. Reason enough why Dings separators are the strongest separators on the market, size for size.

Dings High Intensity MAGNETIC SEPARATION

LIFTING MAGNETS • MAGNETIC CLUTCHES • SEPARATORS

Phosphorus in Steel

(CONTINUED FROM PAGE 37)

of this series was 0.12 per cent C, 0.55 Mn, 0.10 Si, and 0.04 S. In the earlier report[1] it was indicated that the addition of 0.25 per cent Mo to phosphorus steels appeared to be beneficial, particularly in its effect on the notch behavior.

This additional investigation has shown a similar effect, as all of the steels with 0.24 per cent Mo and 0.18 per cent P gave excellent properties. The tensile strength of the normalized sheet was 77,500 lb. per sq. in., the yield strength 52,200 lb. per sq. in. and the elongation in 2 in. was 23 per cent. The Charpy value of the bar stock was 35 ft.-lb. Annealing softened both sheet and bar, as might be expected, while the Charpy value was still 29 ft.-lb. With 0.5 per cent Mo the strength was increased with but a slight effect on the elongation. The normalized sheet at 22 gage had a tensile strength of 92,200 lb. per sq. in., a yield strength of 58,700 lb. per sq. in. and an elongation of 21 per cent in 2 in. The Charpy values of this steel in bar form were 36 and 27 ft.-lb. respectively for the normalized and annealed conditions. From this, the combination of phosphorus and molybdenum appears to be very favorable in these steels. It should also be said that the low-molybdenum steel plus 0.18 per cent P is stronger and but a little less ductile than the high-molybdenum, low-phosphorus steel. The Charpy values were lowered by such a substitution of phosphorus for molybdenum, but not dangerously so.

In the atmospheric corrosion tests the addition of molybdenum retarded the rate of corrosion, as compared with that of mild steel. The addition of phosphorus to the molybdenum steels decreased the rate still further. Upon comparing the steels of this series with those of Series B, it was clear that molybdenum, like tin, was beneficial to atmospheric corrosion in low-phosphorus and ineffective or neutral in its effect in high-phosphorus steels.

Ed. Note:—Next week this report will be concluded with data on mechanical and corrosion tests for Fe-P-V, Fe-P-Cu-Si, Fe-P-Cu-Cr-Si, Fe-P-Cu-Ni-Mo, Fe-P-Cu-Ni, Fe-P-Si-Cu-Sn, Fe-P-Cu-Cr, and Fe-P-Cu-Mo alloys, and a summary will be given for the results determined by the entire investigation.

Andrews

ANDREWS STEEL

IRON AND STEEL products

BLOOMS • FORGING BILLETS • RE-ROLLING BILLETS • SLABS • UNIVERSAL MILL PLATES • SHEET BARS

THE ANDREWS STEEL CO.
NEWPORT, KENTUCKY
DIVISIONS
THE NEWPORT ROLLING MILL COMPANY
THE GLOBE IRON ROOFING & CORRUGATING CO.

Steel Bonded Debt Cut $360,000,000 Since 1925

BETWEEN 1925 and 1938 the steel industry reduced its funded debt by more than $360,000,000, the American Iron and Steel Institute has estimated. The reduction effected a yearly saving of nearly $32,000,000 in interest charges which must be paid before consideration of dividend payments to stockholders.

The industry's funded debt was cut from $1,315,000,000 in 1925 to $953,000,000 at the end of 1938, a reduction of close to 30 per cent. Largely because of the debt-reduction program, annual interest charges on the industry's bonds during the five years 1934-1938 averaged $36,000,000 per year, or little more than half of the average annual interest charges in the five years prior to 1925.

Country Has Eight Standard Rail Mills Against 80 in 1898

OVER the past century the number of rolling mills producing railroad rails has reflected the long-term rise and fall in demand for rails, according to the American Iron and Steel Institute. The number of rail mills increased during the years when American railroads were greatly extending their track mileage, and then decreased as new track construction slacked.

In 1845 there were less than 5000 miles of railroad tracks in the country, mostly laid with light iron rails imported from England. Only three American rolling mills were producing rails in that year.

The number of rail mills in the United States increased rapidly thereafter, however, and by 1859 there were 23 rail mills in the country, and American rails were used almost exclusively by the nation's railroads. The number of rail mills reached a peak in 1898, when 50 mills were equipped for rail production.

At present the steel industry has eight mills for the production of new railroad rails weighing 60 lb. or more per yard. Capacity of those eight mills is rated at about 2,575,000 tons of rails per year, exclusive of light and special rails. That capacity figure is less than the maximum tonnage of rails required annually during the peak of railroad expansion, but with ample supplies of steel available, the rail mills probably would be sufficient to meet a demand equal to any which has been experienced in the last 15 years.

The 23 rail mills in existence in 1859 were located in 11 different states. Pennsylvania had 10 rail mills, and these accounted for about 60 per cent of the total rail output. No rail mills were then located west of Chicago, and none were in the South.

Important changes in the location of rail mills took place within the next 40 years. Pennsylvania still remained the leading rail-making state in 1898, with 16 mills, but as new mills were built in the south, midwest and far west where the railroads were chiefly expanding, the number of rail mills in eastern states declined.

At the present time, the eight rail mills equipped to produce new heavy standard railroad rails are located in six different states. Pennsylvania with two mills, accounts for about 36 per cent of the nation's capacity, while the two rail mills in Indiana account for about 32 per cent.

The peak of rail production occurred from 1905 through 1913, when output averaged over 3,200,000 tons per year. From 1926 through 1929 an average of 2,800,000 tons of rails were produced annually, while in the past five years rail production has averaged a little less than 1,000,000 tons per year.

In recent years the rail market has consisted principally of the replacement of old rails, and to a lesser extent the production of rails for export. Since 1929, a total of only 2500 miles of new lines have been built, while 11,000 miles of line were abandoned.

Cast-to-Shape

ALLOY, AIR-HARDENING AND OIL-HARDENING TOOL STEELS

. . . AND . . .

FLAMALOY

FLAME HARDENING STEEL

KROKOLOY — Chrome cobalt alloy castings for super-high production — air-hardening.

MARTIN STEEL — High carbon, high chrome alloy castings for medium high production — air-hardening.

CASTALOY — A low-priced, high carbon, high chrome alloy — air-hardening.

CARBOMANG — Oil-hardening. A high grade, electric furnace, laboratory controlled steel.

These steels cast-to-shape with minimum machining allowance or file finish.

FOR punches, pads and inserts in large pressed metal dies—where lesser alloyed steels with good physical properties and wear-resistant qualities are desired—our Flamaloy steel castings are extensively used.

After machining Flamaloy castings, the areas or surfaces to be hardened may be heated with a torch and water-quenched for an approximate 600 to 620 Brinell.

Flamaloy castings weld readily and draw beads or joint lines can be built up by this method.

• • •

In addition to these steels in our regular line, we will be glad to quote on any special analysis you may require.

DETROIT ALLOY STEEL COMPANY

Foot of Iron Street — Detroit, Michigan

Steel in Use in Nation Totals 1,130,000,000 Tons

THE amount of steel in use in the United States rose to a new high level during 1938, amounting to approximately 1,130,000,000 tons at the close of the year, as estimated by the Americon Iron and Steel Institute. Included in that estimated tonnage is the amount of steel in the capital goods of the nation such as buildings, bridges, machinery, railroad equipment, ships, and the like, and also the steel in automobiles, house furnishings and other consumers' goods. Since 1900 the amount of steel in use in this country has increased nearly 17 times as fast as the population.

$4,878,459 in U. S. Contracts To Illinois in September

CHICAGO—Government contracts amounting to $4,878,459 were received by Illinois manufacturers during the last three weeks in September, according to the Illinois Manufacturers Association. The two largest individual items were for submarine propelling machinery and steel sheet piling, the latter order which amounted to $1,035,806 going to the Inland Steel Co.

Porcelain Enameling Work Up Sharply in August

AUGUST was the best month for the porcelain enameling industry since October, 1937, according to Department of Commerce figures recently released. Total value of shipments by the 99 manufacturers reporting was $3,697,286, an increase of 17½ per cent over July.

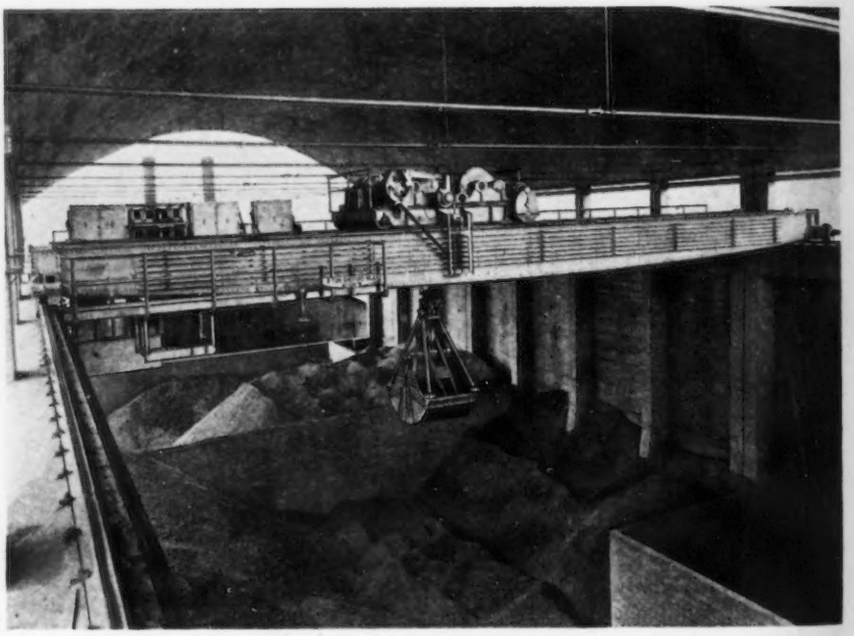
Spang, Chalfant Buys Continuous Pipe Mill

PITTSBURGH—The Spang, Chalfant division of National Supply Co. has purchased an additional Fretz-Moon continuous gass butt weld pipe mill, to be installed at the company's Etna, Pa., works. Another continuous pipe mill had been established at Etna over a year ago.

A.S.M.E. Elects Officers For 1940

WARREN H. McBRYDE, consulting engineer of San Francisco, has been elected president of the American Society of Mechanical Engineers, and will be installed along with other officers for 1940 at the 60th annual meeting of the society to be held in Philadelphia, Dec. 4 to 8. Newly elected vice-presidents are Kenneth H. Condit, executive assistant to the president, National Industrial Conference Board; Francis Hodgkinson, honorary professor of mechanical engineering, Columbia University and former consulting engineer of the Westinghouse Electric & Mfg. Co.; Jerome C. Hunsaker, head of the mechanical engineering department, Massachusetts Institute of Technology; and Kilshaw M. Irwin, vice-president in charge of engineering, Philadelphia Electric Co. Newly elected managers of the society are: Joseph W. Eshelman, of Eshelman & Potter, Birmingham; Linn Helander, head of the department of mechanical engineering, Kansas State College; and Guy T. Shoemaker, president of the United Light & Power Service Co.

This 8-Ton Shepard is EC&M



THESE views show a recent installation of EC&M Frequency Relay Magnetic Control on an 8-Ton Shepard-Niles Bucket Crane in eastern cement plant.

Control consists of EC&M Magnetic Controllers for both (holding and closing line) motors on the hoist motion and also for the bridge motion. Trolley controller is manually-operated type.

Frequency Relays operating on the slip frequency of the motor, have the advantage of exactly matching motor torque to the requirements of the load. This means that closure of acceleration contactors which cut out secondary resistance is accurately regulated to produce smooth operation; motor torque being increased only when the motor has speeded up to the point where more torque is required to further increase motor speed.

In addition, main motor current is handled through EC&M LINE-ARC Magnetic Contactors—an assurance of low upkeep cost in which contact life is increased and destructive burning of the arc shields is eliminated. Their ability to operate fast also produces quick response to the master switch.

Write EC&M Control into your crane specifications for efficient, economical operation.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

Pittsburgh Welding Society to Hear Address By G. F. Wolfe

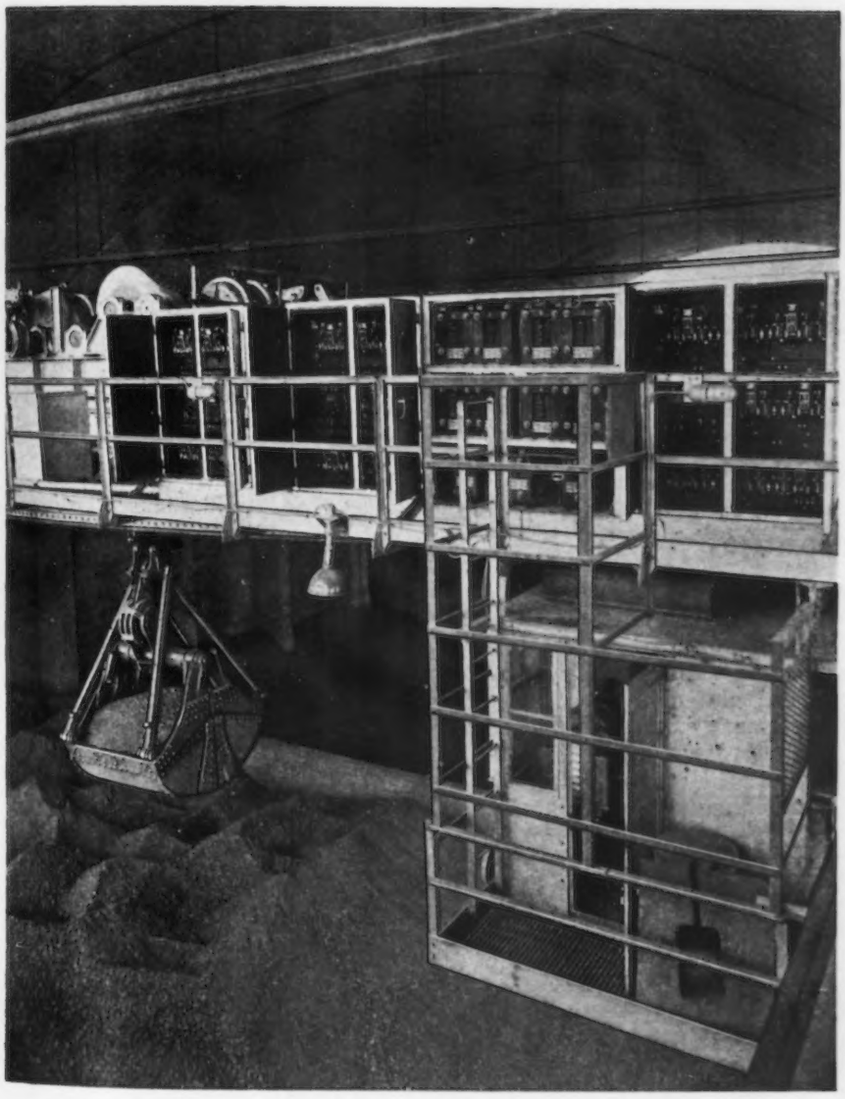
AT a meeting of the Pittsburgh section of the American Welding Society to be held Nov. 16 at the Mellon Institute of Industrial Research, Pittsburgh, George F. Wolfe, chairman of welding committee, engineering works division, Dravo Corp., Pittsburgh, will speak on "The Modernization of a Structural Shop for Welding." Mr. C. Perry Streithof, structural engineer, engineering works division, Dravo Corp., will also speak, the title of his paper being "Welded Cranes and Hoists." Both papers will be illustrated with slides.

New Machine Tool Dealer Organization in the East

THE H. C. Hall Co., has been formed to deal in machine tools in northern New Jersey and lower New York State by Herbert C. Hall, formerly sales engineer of the Vandyck Churchill Co., machine tool dealer firm of New York City. The address of the new company is 1060 Broad Street, Newark, N. J. In setting up his organization, Mr. Hall has taken with him the line of turret lathes and Superfinishing machines made by the Foster Machine Co. and formerly sold through Vandyck-Churchill. Other lines are to be added. Thomas P. Orchard, for the last several years in the production engineering department of the Wright Aeronautical Corp., Paterson, N. J., has joined the Hall firm as sales engineer.

Niles Bucket Crane

FREQUENCY RELAY Controlled



When buying Cranes—
Specify EC&M Control

Private Construction Up as Public Work Declines

INCREASED private construction contracts awarded last month more than offset a moderate decline in contracts for publicly owned projects, according to F. W. Dodge Corp. In consequence, the overall September contract total for the 37 Eastern states, $323,227,000, showed a 3 per cent increase over the preceding month and a 7 per cent increase over September, 1938.

The increase of private-ownership contracts from $153,869,000 in August to $179,011,000 in September was principally due to increased volume of commercial and factory building, residential contracts continuing at approximately the August rate. Factory building contracts in September were practically double the amounts awarded in September of last year and in August of this year, the increased activity in this class occurring principally in Ohio and Texas. The September contract total for factory building was the largest recorded since December, 1937.

The cumulative contract total for the first nine months of this year, amounting to $2,634,802,000, is the highest for any like period since 1930, and is 23 per cent greater than the total for the first nine months of last year.

$1,000,000 Pratt & Whitney Expansion is Approved

DIRECTORS of United Aircraft Corp. have authorized a $1,000,000 addition to the Pratt & Whitney division, East Hartford, Conn. Approximately 274,000 sq. ft. will be added. The corporation has large American, British and French contracts.

Polishing Technique for Stainless Steels

(CONTINUED FROM PAGE 59)

to prevent hammering, and it is desirable to round edges slightly to prevent gouging. A lubricant, such as lard oil may be used to prevent the surface of the wheel from loading. While this may reduce cutting efficiency slightly it will be useful to avoid over-heating and deep abrasive cuts. If a coarse abrasive has been necessary for the first operation, it should be followed by an intermediate number before attempting to finish the whole surface.

Deep pits in light gages of sheets, or strip, as received from producing mills obviously cannot be removed without seriously reducing metal thickness. Such defects are usually a sufficient cause for rejection of material.

If tool and die marks are present on stamped and drawn articles the proper remedy is, of course, refinishing of dies.

Grinding wheel speeds are important. For coarse grinding, speeds of 4000 to 6000 linear ft. per min. (about 1900 to 2800 r.p.m. for an 8-in. wheel) should be used. For finer grinding operations, speeds up to 7000 to 8000 linear ft. per min. (about 3200 to 4200 r.p.m. for an 8-in. wheel) should be employed.

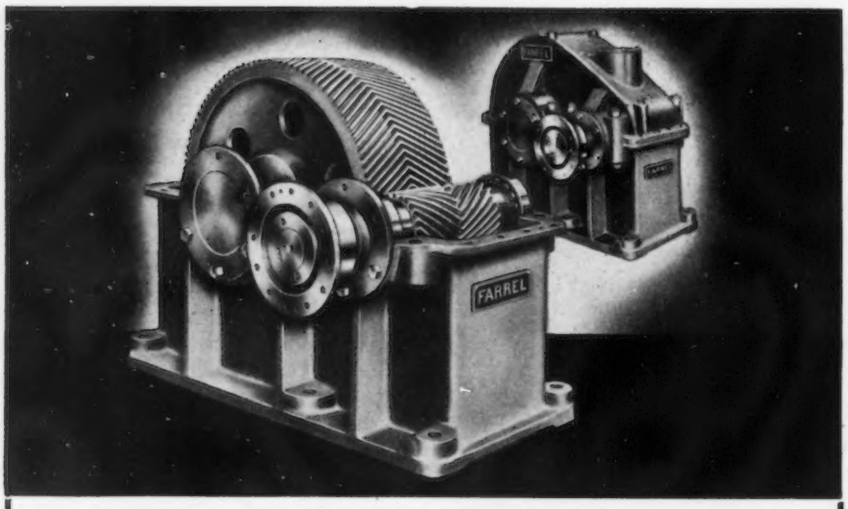
Polishing

After all imperfections have been removed and a clean uniform base secured, polishing should proceed with finer abrasives in succession, first "dry," then lubricated with suitable grease compounds.

Polishing wheels are built up of sections, glued or bonded together; the sections themselves being made of circular disks of muslin, canvas, or other appropriate fabric, usually 10 to 14 in. in diameter. These are mounted on a spindle and secured by heavy flanges and nuts. The width of face is dependent on the number of sections and is determined, more or less, by the nature of the work. For local polishing a narrow face wheel will be more efficient, but for large surfaces a wheel with face as wide as can be manipulated conveniently will save time.

Sections are built up of layers of 64/68 to 84/92 count unbleached muslin, sewed in various fashions, i.e., spirally, radially, concentrically, or in the form of crescents, or arcs, from the center to the periphery to produce a firmer center with soft or "cushion" circumference. For hard cutting, "roughing out," a harder surface is required, while for "fining" either dry or with grease, more cushion is necessary.

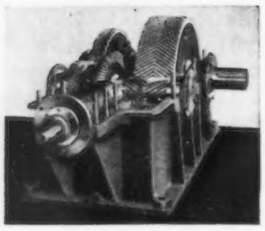
The method in which an abrasive of given grit number is manipulated affects markedly the character of the finish produced. For example, No. 120 grit used on a soft wheel will give a different cut from No. 120 on a hard wheel. Again, No. 120 on a cloth wheel will give a different result from No. 120 on a belt machine. Neither does the finish obtained with used wheels compare with that of a freshly set-up wheel. For, a new wheel with No. 150 grit may actually produce coarser scratches than a broken-in wheel with No. 120. Even the speed of the wheel affects the finish, higher speeds producing more brilliant fin-



Farrel Single Reduction Unit—Type SR

FARREL GEAR UNITS

Perform Dependably and Economically under all Conditions of Service . .



Farrel Right-Angle, Two-Speed Gear Unit.

This catalog, No. 438, gives complete descriptions, specifications, ratings and dimensions. Send for free copy.

The greater strength and load-carrying capacity of Farrel-Sykes continuous tooth herringbone gears are important factors in the durability and efficiency of Farrel Gear Units. The rigidity of their heavy cases eliminates deflection and vibration. Operation is smooth and quiet. They give silent, positive, uniform transmission of power.

The complete series of these units includes single, double and triple reduction units, speed change units with two or more selective speeds, right angle units and drives to suit special needs. Speed increasing units are also supplied. All offer the advantages of standardized general design, with flexibility in detail which permits variation to suit specific conditions of speed, load and service.

FARREL SYKES GEARS

FARREL-BIRMINGHAM COMPANY, Inc.
333 VULCAN STREET - - - - - - - BUFFALO, N. Y.
The Gear with a Backbone

ishes. Thus, the statement that a certain finish has been produced with No. 180 abrasive carries little information unless all details regarding the manner of its use are available.

"Dry" abrasives have greatest cutting efficiency, and are always used for rapid work where much metal is to be removed. Finer abrasives cannot be used dry without danger of overheating the work and causing distortion. For this reason polishing up to, and including, No. 100 grit is almost invariably done dry, i.e., without lubricant. Finer abrasives, such as No. 120, No. 180, and higher, are always used with lubricant. Lubricated, or "greasing" operations always give higher luster finishes.

The selection of lubricants must be done with care as they play a very important part in the production of fine finishes. Lubricants are usually compounds of mutton tallow and stearic acid, and should be at least 50 per cent saponifiable. Solid mineral lubricants (paraffin, etc.) are not recommended. Generally considered, harder and stiffer lubricants clog the wheel and act to retard cutting, thus giving finer and more brilliant finishes with a given grit number than the softer lubricants which permit freer cutting.

In polishing operations it is good practice to conduct each succeeding step with an abrasive about 20 to 40 numbers finer, as No. 80, then No. 120, No. 150, and so on. While it may not always be possible to maintain this sequence, nevertheless, it is a good basis on which to plan operations.

Dry abrasives are applied to the circumference of the wheel with glue or cement. This is by no means a haphazard operation but must be carefully and properly done. The following procedure for a "set-up" wheel is suggested.

Preparation of Wheel

After the wheel has been built up with sections to the proper width of face and firmly clamped by screwing down the nuts on the spindle, it is mounted on a lathe and the surface trued for balance.

While it may appear a minor matter, the selection of a proper grade of glue is very important, as the quality of the polish, as well as its "color," may easily be spoiled with inferior glue. Only first-run hide glue of best quality should be used. The glue solution should be made up by weighing glue and water in proportions given below, or as recommended by the glue manufacturer. If ground, the glue should be soaked in cold water for at least 1 or 2 hr.; if flake glue is used, it should be soaked for at least 6 hr. When thoroughly softened, sufficient clean and cold water should be added to the glue to give the desired composition, and then it should be heated slowly in a double boiler to 140 deg. F. Higher temperatures will destroy the properties of the glue, and the use of a thermostatically controlled glue pot is, therefore, recommended. This pot should be vitreous enamel lined and have a water jacket. As glue solution deteriorates with time, it is advisable to make up fresh glue solution each day.

After the wheel has been trued and balanced, the surface is sized with one or two coats of thin (5 to 10 per cent) glue solution, which is applied hot to the preheated wheel. It is then dried. After sizing, at least two coats of abrasive in glue, applied hot, will be necessary, drying carefully after each coat.

The strength of the glue solution

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● The Pittsburgh Coal Company operated two 6-ton coal bridges at their Superior, Wis., docks. One bridge alone was incapable of handling the total traffic, yet the operating costs of the two bridges constituted too great an overhead. Dravo designed a man trolley of aluminum, greatly increased the speed of travel without over-stressing the structure, and raised the capacity of one bridge to 12 tons. By eliminating the use of the second bridge, operating costs were reduced proportionately.

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should vary with the grit number according to the following table:

Grit Number	Glue in Solution (Per Cent by Weight)
60 to 70	40
80 to 90	35
100 to 120	33
150 to 180	30
220 to 240	25

The abrasive should be heated before mixing with the glue to avoid chilling the solution. It is important to stir the mixture thoroughly when applying to the wheel, especially when using coarse abrasives which, being much heavier, settle to the bottom and make even coating difficult.

Another method is to coat the wheel surface with glue solution and then roll the wheel in a shallow trough containing the loose, dry, abrasive. This method is preferred for coarse abrasives and ensures a more even "head."

After each coat of abrasive in glue, the wheel should be allowed to dry undisturbed in a heated room for 24 hr. Usually a second coating will be required, followed by another drying period. The wheel is then trued, if necessary, and broken in on scrap stainless steel. If greater flexibility of surface is desired the surface may be broken by hammering slightly with a short length of bar. When recoating becomes necessary the wheel surface should be scoured with a carborundum brick, and again trued. One or more coats of abrasive in glue are then applied, and dried, as before, and the surface broken in on scrap. This latter is important, the fresh abrasive surface should always be broken in before being put into service. A finer abrasive should never be applied to a wheel on which a coarser has already been used, nor should abrasives of different compositions be mixed together, as for instance aluminum oxide with emery.

There are prepared binders or "cements" now available commercially that may be used in place of glue. They have the advantage of not requiring preliminary soaking and heating, and time is saved by their use. They do not deteriorate on standing, are not affected by temperature or humidity, and are available for immediate use. Cement coated wheels are, however, inclined to give a harder, sharper, and more open cut, and finer sizes of abrasive may be required to give the desired finish. Cement has the advantage of shorter drying time, although, as with glue, cement coated wheels should be dried in a heated room. In no case should cement be applied to a wheel on which glue has previously been used unless all traces of glue have been completely removed.

Other types of wheels, which eliminate the troublesome delays of glue preparation and drying, have been developed and are finding much favor. One of these, that is particularly well suited for flexible shaft operation and local polishing, is the rubber cushion type (Quick-As-Wink wheel). This wheel consists of a small, flat, pressed steel drum, the circumference of which is overlayed with a thick layer of soft rubber. The abrasive is provided in the form of cloth belts coated with aluminum-oxide in grit sizes from No. 24 to No. 320. The construction is simple and sufficient cushion effect is supplied; and, owing to the ease and rapidity with which belts can be changed, fresh abrasive, or abrasive of a different grit number becomes instantly available.

Ed. Note:—Next week the author will give detailed data on polishing to various finishes; also, etching and protection of stainless surfaces.

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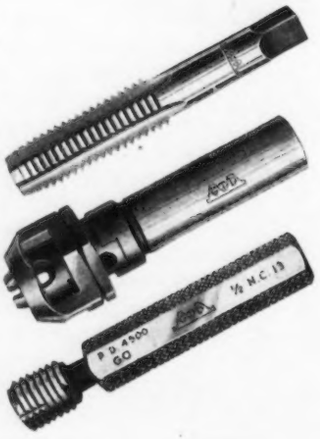

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Price Decisions Must Be Based on Economic Necessity Not Threats From Washington, Says E. T. Weir

NEW YORK—Threats from Washington of "dire consequences to the steel industry" in the event of steel price increases were criticized in an address Tuesday night by Ernest T. Weir, chairman of National Steel Corp. and president of the American Iron and Steel Institute.

Mr. Weir spoke on "Profits and Patriotism" at the annual meeting of the American Institute of Steel Construction which was held early this week in the Waldorf-Astoria Hotel, New York.

The steel leader's comments on steel prices were evoked by statements of unnamed "economic advisers" to President Roosevelt who were quoted in a recent newspaper article as saying, "a steel price advance and its consequences would produce 'irresistible' pressure for new control plans and other forms of governmental interference with business."

Industry Itself Should Decide

"Whatever price action is to be taken is a matter to be decided by individual (steel) companies," Mr. Weir said. "And I believe their decisions must be based on urgent economic necessity rather than upon political threats from Washington."

The institute president pointed out that despite great increases in the prices of raw materials essential to steel manufacture in the past two months, the great majority of steel companies had not increased prices of finished steel. Only companies which were unable to cover their raw material needs before prices went up made any increase in the price of steel products, he stated.

The greatest increase has been in the cost of scrap steel, Mr. Weir said, but all raw materials that go into the making of steel have advanced in price. As examples he mentioned ferromanganese which advanced 25 per cent; tin, 17 per cent; zinc, 35 per cent; fuel oil, 18 per cent, and coal 10 per cent.

Mr. Weir predicted that there would be no immediate advance in steel prices but doubted that steel companies could long absorb the increasing cost of raw materials.

No Adequate Increase Seen

"I wish to point out that these higher raw material costs have been offset only in part by the currently increased rate of operation," he said. "I do not foresee any increase in prices which will fully cover these greater costs. However, I do not doubt that most mills will at some time find it necessary to recover at least some part of these increases.

"The profit experience of the steel industry provides the background against which this radical increase in the price of raw materials should be considered," he continued. "The average net profit of the entire industry, before dividends, in the last three

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years has only $4.07 a ton of products produced for sale. After preferred dividends, which are a fixed charge, net dividends were only $2.14 in this period. In the first six months of 1939, net profits before preferred dividends were $1.71 per ton, while after dividends, they were 27c. a ton.

"These figures show conclusively that the steel industry has no margin from which to absorb any large increase in costs. What I have just related is the economics of the situation. Costs and prices in the steel industry are hard, unyielding facts which cannot be changed at will to conform to political desires in Washington."

Upswing Like Cream Puff

Mr. Weir pointed out that the profit system is the American economic system. Unless industry earns reasonable profits, he pointed out, investors withhold their savings from the use of industry producing conditions which results in demands for control of business by government.

The steel leader characterized the present business boom as unsound, saying that it rested "on a foundation about as firm and strong as the filling in a cream puff." He remarked that the country must not lose sight of unemployment and other domestic problems and stated that when peace returns "these problems will be there waiting, and redoubled in size and in gravity." After describing the failure of the steel industry and the steel construction industry to earn profits during recent years, Mr. Weir placed major responsibility for this condition on the shoulders of management.

"There is only one place to put the blame for this," he said, "and it is not on government. Government is indirectly but not directly responsible. Government has increased the costs of business, has added new costs, and has created the general conditions which have deprived business of satisfactory volume. But government has not yet assumed the control over prices which would make it mandatory for business to operate at a loss. No, the direct responsibility for non-profitable business must be placed squarely on the doorstep of industry's own management."

Up to Individual Companies

The solution to the problem of earning profits is one that each company must fight for itself, Mr. Weir emphasized.

"I am not suggesting that companies in an industry get together and agree on prices," he said. "There are many phases of business on which companies can cooperate through their trade associations to their own and the public benefit. Price is not one of them. A price policy is one that must be established by each individual company in accordance with cost and other factors peculiar to that company. The job of each individual company is to see that its prices cover its own costs, not empirically established average costs of its industry. Where this is done, prices inevitably gravitate to the point at which the more efficient producers can cover costs and make a profit. Lower prices established by this method are economically sound."

In contrast to lower prices that are the result of efficient operation, Mr. Weir pointed out, "lower prices that are due to sacrificed profits and costs rob stockholders, ruin companies, degrade standards of the industry, and actually threaten existence of the system of private enterprise."

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"In no country on earth have political liberty and personal liberty survived the destruction of the economic liberty of the people. And if the gentlemen in Washington, who are so intent on making America over, ever get their hands on the controls they want, we do not know exactly what will happen. But we may be sure our system of life will not be the American system—and also that it will not work any better than it has in other nations where one man or a small group has assumed the power to do the thinking and directing for an entire people."

—E. T. WEIR.

There is no conflict between profits and wages, the steel leader stated. "There is a strong popular belief that profits and wages are opposed to each other—that one can be increased only at the expense of the other," he said. "Of course, the opposite is true. Records of poor times and prosperous times in the United States show that wages and profits go up and down together. Furthermore, the highest wages have been paid consistently in the industries and companies with the best profit records. It is obvious that a profitable company is under neither temptation nor necessity to reduce wages or resort to sweatshop practices in the effort to make ends meet. The profitable company not only gives higher and steadier wages and better working conditions to employees, it also contributes to the prosperity and progress of the community of which it is a part."

War Will End Freedom

After stressing the need for America to prepare now for trying conditions at the cessation of war, Mr. Weir said:

"We have a chance if we don't go soft. We have a chance if we keep these problems as fresh in mind as they were a few short weeks ago—as fresh in mind as they are to the fellow who is still out of a job. We have a chance if we keep everlastingly hammering to see that these problems are met with sound domestic solutions. We have a chance if America stays out of war. If America goes into war, I am afraid that none of us here will live to see again the freedom which we once so calmly regarded as our natural birthright. War this time places at stake not only American lives and treasure, but the very principles which have made Americans the world's first real race of freemen."

Collectivist Idea Gains

"Our credit structure now strains under a debt of about forty-five billions," he continued. Add to these billions the many billions more that would be poured into a war venture and what would happen? Capitalism would be expected to foot the bill for this as it is for everything else. When it failed, as it would, what would be blamed? You know the answer. The capitalistic system, of course. Out with it! Let's try another! What other! I don't know the answer to that. But I do know that the collectivist idea has made deeper inroads in American government than anyone would have thought possible a few

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short years ago. I know that in event of war we can expect a degree of regimentation and control by government that is now unthinkable, and I know that the conditions that will follow war will be much less conducive to the return of individual freedom than they will be to the flowering of collectivism with its inevitable climax—dictatorship."

"The present, imperative duty of any real American is to keep America out of war," Mr. Weir concluded.

Administration Circles Threaten Price Control If Steel Is Advanced

WASHINGTON — With the steel industry being given chief attention, Administration economic advisers are trying to prevent price rises and further accumulation of inventories. Other metals that are being watched closely are steel scrap and copper. Implications are that Government control will be sought unless prices and inventories are held down. It is contended that if these forces get out of hand a sharp recession in prices, operations and employment will develop. The opinion prevails that war hysteria has brought about a wave of speculative buying with resulting price increases in many commodities, as well as an accumulation of stocks.

While the steel industry has been given the blessing of the Administration for its price policy, reports that higher levels for the first quarter are in contemplation have aroused opposition among "liberal" advisers. Apparently theirs is the prevailing view. Some of the more conservative advisers take a somewhat different position and think there is justification for first quarter steel price rises of perhaps $2 to $3 per ton. This group nevertheless appears to form a decided minority. There is still another minority group which thinks steel prices should be reduced.

The focusing of attention on the steel industry is based on the contention that it is a key industry whose price policy governs the entire industrial price structure. Since the necessity of a balanced price structure is being emphasized it is urged that the start should be made with steel. If its prices can be held, then it is contended other industrial prices will stay in line. Especial effort, so it is claimed, is being made to establish and maintain a proper relationship between industrial and agricultural prices. But at present the Administration is of the opinion that the relationship is out of balance. Agricultural prices are said to be too low and an increase in them without increasing industrial prices, is held to be desirable.

The steel situation is being given particular attention by certain members of the Temporary National Economic Committee from the executive branch and from the Department of Commerce and the Department of Justice. It is considered significant that the report of this activity has been made known on the eve of the TNEC steel inquiry. The investigation is to be started Oct. 30. Some see in this a timing by economic advisers to use the TNEC as a club to prevent price increases. There is now no price control law. But meanwhile implied threat of control over prices clearly is

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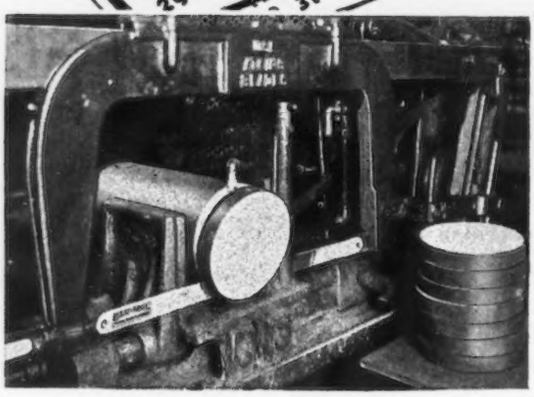

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intended to achieve the objective. This is further indicated by hints thrown out that if no price advances are made no control will be attempted. Anti-trust action also is being intimated, seriously or otherwise, to restrain price increases, though aside from that in the Department of Justice it appears to be the view that such action would not accomplish the purpose desired. Assistant Attorney General Arnold, however, holds fast to the point that the Department of Justice investigations already have restrained price increases in the steel, sulphur, newsprint and potash industries so far this year.

In any event the TNEC is expected to take a leading part in its forthcoming inquiry in seeking to hold down steel prices. Administration advisers insist that the move to halt prices and inventories is not an idle threat or bluff. In some quarters a contrary view is held. The Administration advisers are so fixed in their opinion that steel prices should not be advanced that they reject the contention that higher levels are justified because of increased costs of such raw materials as scrap, ferromanganese, lead and zinc. It is maintained that prices of raw materials have not as yet reached a point to warrant higher steel prices.

While the TNEC has no authority to put teeth in any plan it might recommend in the way of curbing prices, price advisers close to the Administration insist that Congress would give them whatever power was requested as necessary. At least some members of Congress, prompted by reports of rumors of price rises and scores of communications from consumers, have asked TNEC officials what they intend to do about it and seem to think that the joint Congressional-executive body already has some power to proceed.

Fearful of Recession

At least some New Deal advisers feel that the price situation in steel in the past several months has been highly satisfactory to the Administration and that price increases at this time would not only be unjustified but would operate to the industry's disadvantage in a few months hence, at which time New Deal advisers are fearful of a recession. Even after weighing the increased costs due to price rises of scrap and other raw materials, these advisers express the view that price increases by the steel industry would not be justified.

While there was no indication that the White House actually had been advised of this feeling, yet the idea is receiving so much consideration in the inner circle councils that it presumably is only a question of time before that will be done.

One Administration adviser who has been following the steel price trends closely during the past four years, and who is expected to take an active part in the TNEC steel inquiry, told THE IRON AGE that while a number of plans to curb price rises are under consideration by several Government agencies the Administration actually is uncertain just what steps it would take in event price increases were announced in the steel industry.

Asked at a press conference Tuesday afternoon whether he had given any thought to the effect of a price increase in steel on the national economy at this time, President Roosevelt replied that he did not think there is anything new on the subject. A similar response was made when he was asked about copper prices.

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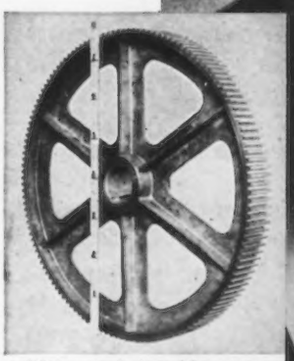

1 High speed deposition saves time in producing large gears. *Photo: Lakeside Bridge & Steel Co., Milwaukee, Wis.*

2 Ample physical properties for welds in heavy duty equipment are assured by using Murex. *Photo: S. Morgan Smith Co., York, Pa.*

4 It's easier to qualify welders for pressure vessel work with Murex. *Photo: Edge Moor Iron Works, Edge Moor, Del.*

3 Welders prefer Murex because slag removes readily; saves cleaning time. *Photo: Ira Bushey & Sons Co., Inc., Brooklyn, N. Y.*

5 Ten cents per pound of weld metal were saved by Murex on one tank fabricating job. *Photo: Stearns-Roger Mfg. Co., Denver, Colo.*

. . . THE NEWS IN BRIEF . . .

Canadian War Supply Board will start placing war contracts with Canadian companies in the next week or two.—**Page 65.**

Rise in automobile production during past eight weeks halted by Chrysler strike. . . . Company asserts its right to control production.—**Page 65.**

1939-1940 directory of materials.—**Page 69.**

New Deal afraid of a war boom and resultant collapse when peace comes.—**Page 70.**

Another U. S. warning against exporting strategic materials.—**Page 74.**

TNEC steel hearings again postponed to Oct. 30.—**Page 74.**

Fair profit on U. S. war-time contracts unofficially given as 6 per cent.—**Page 76.**

War-time exports of steel and machine tools.—**Page 78.**

1940 catalog and directory issued by A.S.M.E.—**Page 78.**

Government department concerned over Walsh-Healey wage decision.—**Page 80.**

Meehanite Research Institute will hold its annual meeting Nov. 1-3 in Detroit.—**Page 81.**

Winchester Repeating Arms gets $8,710,000 order for rifles; Ordnance Department awards total $15,147,818.—**Page 82.**

Government purchases of iron and steel products in recent week total $2,663,044.—**Page 83.**

Labor board rulings.—**Page 84.**

Steel industry funded debt reduced $360,000,000 between 1925 and 1938.—**Page 88.**

The United States has eight standard rail mills compared with 80 in 1889 when railroads were expanding.—**Page 89.**

Porcelain enameling work up sharply in August.—**Page 90.**

American Society of Mechanical Engineers will hold 60th annual meeting at Philadelphia.—**Page 90.**

Amount of steel in use in U. S. reaches 1,130,000,000 tons at close of 1938.—**Page 90.**

Spang, Chalfant division of National Supply Co. buys continuous gas butt weld pipe mill.—**Page 90.**

Government awards $4,878,459 in contracts to Illinois manufacturers during September.—**Page 90.**

New machine tool dealer organization in the East.—**Page 91.**

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MEETINGS

Oct. 16 to 20—National Safety Congress and Exposition, Atlantic City, N. J.

Oct. 23 to 27—National Metal Congress, Chicago.

Oct. 24 to 26—Purchasing Agents Association of Baltimore, products exhibit, Baltimore.

Nov. 15 and 16—National Founders Association, New York.

Private construction gains as public work declines, according to F. W. Dodge Corp.—**Page 91.**

$1,000,000 addition to Pratt & Whitney plant is authorized.—**Page 91.**

Pittsburgh section of American Welding Society to hear welding address by George F. Wolfe.—**Page 91.**

Price decisions must be based on economic necessity, not threats from Washington, says E. T. Weir.—**Page 95.**

Administration circles threaten price control.—**Page 98.**

National Association of Manufacturers stress industry's desire for peace.—**Page 102.**

Improvements in manufacturing methods cut some steel prices by as much as 75 per cent in last 100 years.—**Page 102.**

Sloss-Sheffield Steel & Iron Co. launches program to raise U. S. ferromanganese annual output 30,000 tons.—**Page 102.**

American Society of Mechanical Engineers elects Warren H. McBryde as president.—**Page 104.**

International Steel Cartel is functioning only in a limited way under war conditions.—**Page 104.**

Machine tool plants gradually approaching limit of available skilled labor. Delivery promises still advancing, with no letup in order rate. Buying particularly heavy in the East, where military business predominates. Price advances up to 20 per cent on deferred shipments.—**Page 126.**

Fifty-eight Tennessee Coal, Iron & Railroad Co. employees given service medals during the third quarter of 1939.

Westinghouse considers building plant to make equipment for airplanes.

Machine tool builders' index of monthly orders will be revised.

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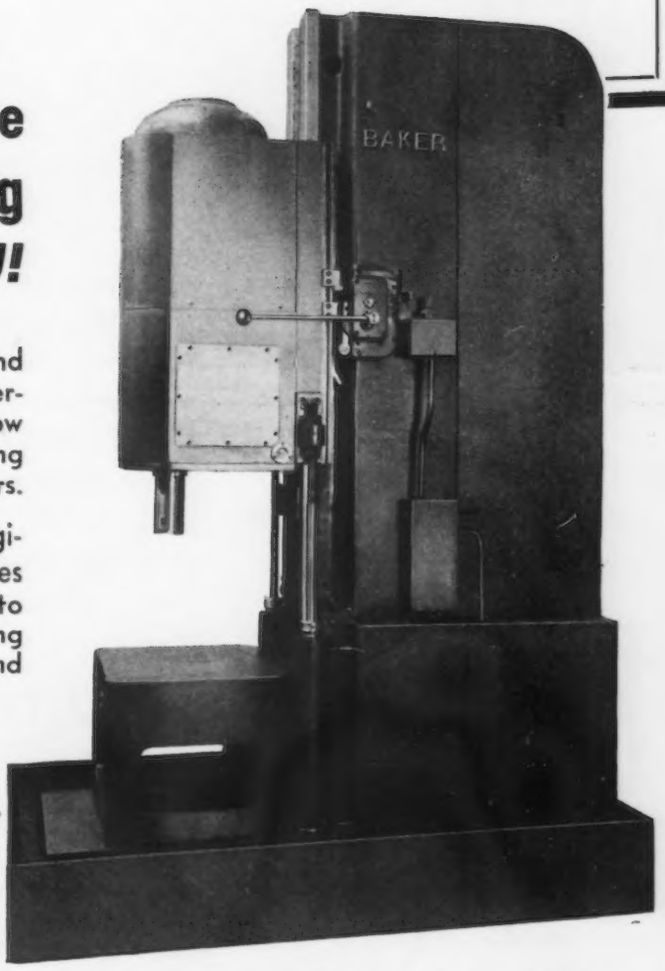

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Stress Industry's Desire for Peace

CINCINNATI—Industry's desire for peace keynoted the regional meeting of the National Association of Manufacturers in Cincinnati, Oct. 13. Three hundred industrial leaders attended the dinner Friday night. The speakers included E. T. Weir, chairman of the National Steel Corp.; Howard Coonley, president of the association and chairman of the Walworth Co. and Walter B. Weisenburger, executive vice-president of the association. Charles R. Hook, president of the American Rolling Mill Co., was toastmaster.

"I am absolutely opposed to war and war profiteering, and I am sure that most business men are," Mr. Weir declared. "In the last month, since war started, I have yet to meet a manufacturer, large or small, who wants war."

Turning to the system of private enterprise, Mr. Weir declared that American business has made the mistake of apologizing for the profit system. Instead, he asserted, industry would serve itself, and the country, better if it told the people, by every means of public communication, that the American system is the profit system and that without the one you do not and cannot have the other.

"Industry hates war. American industry wants peace. Peace is the lifeblood of progress. Peace must be the national objective," Mr. Coonley said.

Improvements Cut Steel Prices Sharply

IMPROVEMENTS in manufacturing methods have permitted drastic reductions in prices of iron and steel products from the levels prevailing 70 to 100 years ago, the American Iron and Steel Institute has determined. For some products, prices have been reduced as much as 75 per cent, although in the past century the hourly wages paid by the industry have increased nearly seven-fold, from 13c. an hr. to more than 83c.

One of the biggest price reductions has occurred in steel rails. In 1868, a year after steel rails were first produced in this country, they were sold for as much as $174 per ton. The current price of $40 a ton represents a reduction of 77 per cent from the 1868 level notwithstanding the fact that the quality of rails produced today is vastly superior to the quality of the early steel rails.

Similar reductions have been made

in other products of the industry. In 1839, before any important tonnage of steel was made in this country, hammered bar iron sold as high as 4.5c. per lb. Today the price of a steel bar, stronger and much more versatile, is 2.15c. per lb., less than half the price of an iron bar a century ago.

Pig iron sold for as much as $34 per ton in 1839, or 40 per cent higher than the price today of a ton of No. 2 foundry iron at principal Northern furnaces.

Sloss-Sheffield Will Lift Ferromanganese Output By 30,000 Tons

BIRMINGHAM — The United States' annual output of ferromanganese was increased by 30,000 tons when the Sloss-Sheffield Steel & Iron Co. on Oct. 15 launched a new ferromanganese manufacturing program.

Approximately equal to the amount of ferromanganese now being imported, this increase is significant at a time when shipments from abroad face mounting war-time dangers, it was pointed out. U. S. imports in 1938 were 26 258 tons, and in 1937, 25,599 tons. The major portion in 1938 was imported from Norway, followed by Holland and Czechoslovakia.

It was stated that the ferromanganese to be manufactured here by Sloss-Sheffield would be made from manganese ores shipped from Cuban deposits. Improved processes for the beneficiating of low grade deposits there have recently been developed by American capital. Because of the relatively safe sea lane from Cuba to Mobile, the inauguration of an additional American ferromangansese producing unit using the Cuban raw material was viewed as contributing to the self-sufficiency of the American steel industry in the light of disturbances of ocean-borne shipments from such manganese ore producing countries as Russia, India, Africa and Brazil.

58 T.C.I. Workers Honored

A TOTAL of 1639 years of service by 58 employees with the Tennessee Coal, Iron & Railroad Co. and affiliated companies in the Birmingham area was recognized with the award of United States Steel Corp. service medals during the third quarter of 1939, Robert Gregg, president, announced.

ARMSTRONG

ANNOUNCES the NEW C-39 Catalog

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  —a complete System of tool holders for every operation on lathes, planers, slotters and shapers.
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- ARMSTRONG "C" CLAMPS
  Drop Forged, 5 types, all sizes.
- ARMSTRONG SETTING-UP TOOLS
  A complete line of Strap Clamps, Planer Jacks, T-slot Bolts, etc.
- ARMSTRONG CARBON STEEL WRENCHES
  28 types each in all sizes, also sets.
- ARMSTRONG-VANADIUM WRENCHES
  19 types—open end box socket wrenches.
- ARMSTRONG DETACHABLE HEAD SOCKET WRENCHES, BRIDGE RATCHETS and HOLLOW SCREW WRENCHES
  11 types, all sizes and sets with drop forged ratchets, handles and extensions.
- "ARMSTRONG BROS." PIPE TOOLS
  The most complete line of pipe tools manufactured.

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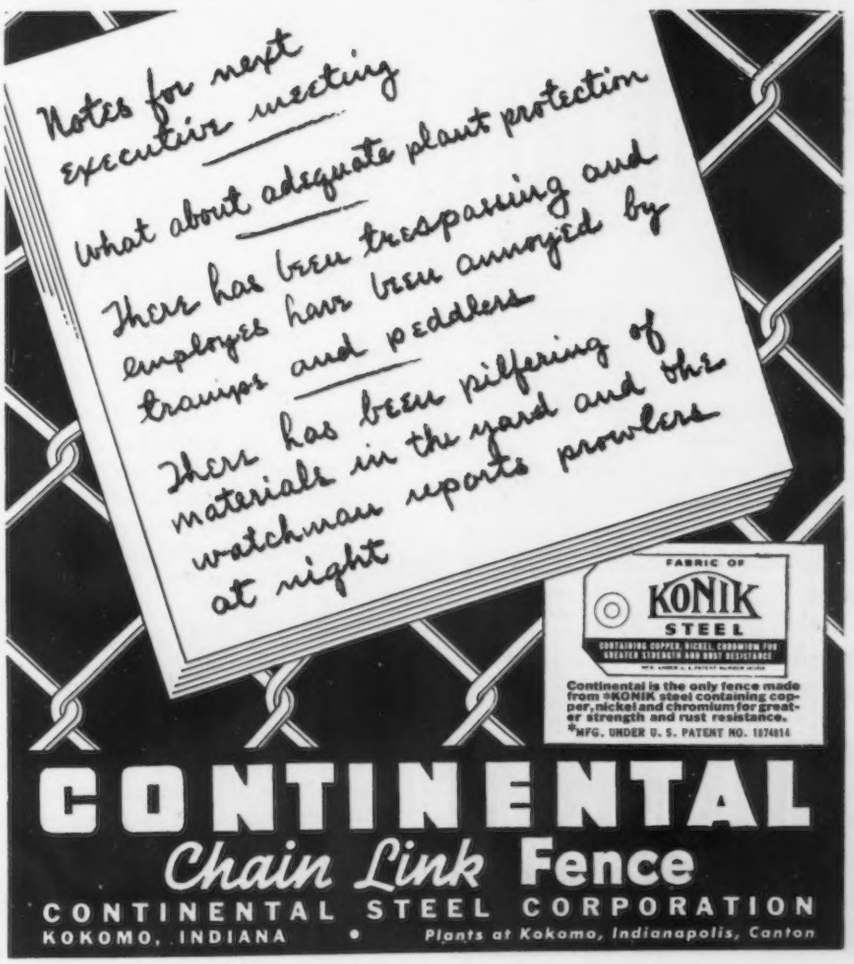
Notes for next executive meeting
What about adequate plant protection
There has been trespassing and employees have been annoyed by tramps and peddlers
There has been pilfering of materials in the yard and the watchman reports prowlers at night
FABRIC OF
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CONTAINING COPPER, NICKEL, CHROMIUM FOR GREATER STRENGTH AND RUST RESISTANCE
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Cartel Functioning Only in Limited Way During the War

LONDON — The outbreak of war automatically brought to an end the existing arrangements of the European Steel Cartel. At this early juncture nobody can say whether or not the Cartel will function in a limited degree for as long as circumstances permit, or whether the organization will become moribund until peace is reestablished.

The members of the Cartel were France, Belgium, Germany, Luxemburg and Britain, while the United States makers had an arrangement binding the majority of the big exporters. The Polish industry was also working in agreement with the Cartel. There is no doubt that in the British and French and neutral countries there is a strong desire among the steel makers to continue the Cartel organization in some form during the war. So long as the British and French industries remain under State control, however, it is difficult to see how a suitable arrangement can be made, even if the Cartel's activities were limited to maintaining a certain control over the export markets.

The German industry has, of course, ceased to exist as a factor in the steel trade of the world while the war lasts; on the other hand, the Allies' war requirements are likely to be on such a scale that there may be little surplus for export. The French and Belgian markets also may find that the circumstances of war will make trading with overseas markets difficult, while lack of cargo space due to the submarine campaign, increased war risk insurance and fluctuating exchanges will add to the troubles of export business.

Since the outbreak of war America has been practically the only country which has been in a position to take full advantage of the export orders available. Undercutting by American concerns in the export market has, since the outbreak of war, completely disappeared.

Should the Cartel find it impossible to control export trade, the organization will probably be of use in settling differences which may arise regarding the supply of steel between the Allies and the neutrals.

It is announced that Dr. Fritz Thyssen, president of the German Steel Trust and of the International Raw Steel Cartel, has fled to Switzerland. He left Germany, he stated, because General Goering was usurping his position in the Werke group of steel manufacturers. His losses are understood to amount to several million marks.

A.S.M.E. Will Hold Annual Meeting at Philadelphia, Dec. 4-8

BROADENING the usefulness of the mechanical engineering profession will be the keynote of the 60th annual meeting of the American Society of Mechanical Engineers to be held in Philadelphia, Dec. 4 to 8, according to an announcement made by Nevin E. Funk, vice-president of the Philadelphia Electric Co., and chairman of the general committee arranging the meeting. An attendance of more than 3000 mechanical engineers is expected.

All functions of the meeting, the first one held outside of New York City since 1890, will take place at the Bellevue-Stratford Hotel. Present plans call for 35 technical sessions at which 105 papers will be presented; a get-together smoker and introduction of 1940 officers of the society on the evening of Dec. 5; the annual banquet and conferring of medals and awards on Wednesday, Dec. 6; College reunion luncheons and dinners on Thursday, Dec. 7; and the fourth annual A.S.M.E. photographic exhibit all week.

The personnel of the general committee for the meeting includes the following members, all from Philadelphia and vicinity: W. L. Batt, president, SKF Industries, Inc. (finance); C. E. Bonine, consulting engineer (photo exhibit); L. C. Bosler, mechanical engineer, Coleman & Co.; J. M. Barnes, mechanical engineer, Philadelphia Electric Co. (technical events); Everett Chapman, president, Lukenweld, Inc. (college reunions); H. A. Hoffer, U. S. Pipe & Foundry Co. (reception); H. A. S. Howarth, Howarth Pivoted Bearings Co. (luncheon); C. C. Jones, mechanical engineer (publicity); L. V. Place, vice-president, McCahan Sugar Refining Co. (hotel) and D. R. Yarnall (chemical engineer) Yarnall-Waring Co. (honors).

Steel Construction Institute Members At Annual Meeting

NEW YORK—Builders of steel bridges and buildings gathered here Monday for the 17th annual convention of the American Institute of Steel Construction at the Waldorf-Astoria. The convention was preceded by a meeting of the board of directors which received and approved the annual report of the institute.

President C. G. Conley said: "War tends to divert our sources of supply, to deprive us of the raw materials essential to construction. If war comes here we are more likely to be denied the product essential to our business even though we found many opporpunities to sell steel structures."

Robert T. Brooks, executive vice-president, said: "I find myself looking back over the earnings of our industry for the first nine years of this current decade (1930-1938) as reported by Robert Morris Associates, and it presents a distressing situation. During those nine years the value of the products shipped by this industry amounted to a billion dollars, approximately, while the approximate profits totaled only three million dollars, or three-tenths of 1 per cent on sales."

V. G. Iden, secretary, reported that the membership now consists of 132 concerns located throughout the United States, and these concerns fabricate approximately 80 per cent of the volume of fabricated structural steel sold in this country.

F. H. Frankland, chief engineer, reported that research programs now in progress involve (1) stress distribution in steel rigid frames, (2) battledeck floor, (3) plate girder tests, (4) short column investigation, (5) perforated cover plates. The engineering section is also making special studies of welding, cold-driven rivets, and cleaning and dehydrating structural steel.

T. H. Hendrix, director of statistics, reported: "Structural steel bookings for the first eight month of 1939 have totaled 869,875 tons as compared with a total of 692,885 tons for the same period of 1938, or an increase of 26 per cent. The amount of new business booked each month this year has exceeded the corresponding month of 1938 with the single exception of August. However, to maintain this gain over last year, the bookings for the remaining four months of 1939 must hold to a high average.

WAY BACK IN 1854

When Commodore Matthew Perry was opening the ports of Japan, this Company was pioneering in the Bolt and Nut Industry.

We can supply you with anything—standard or special—in the form of a Bolt, Nut or Screw.

Give this dependable source of supply an opportunity of quoting.

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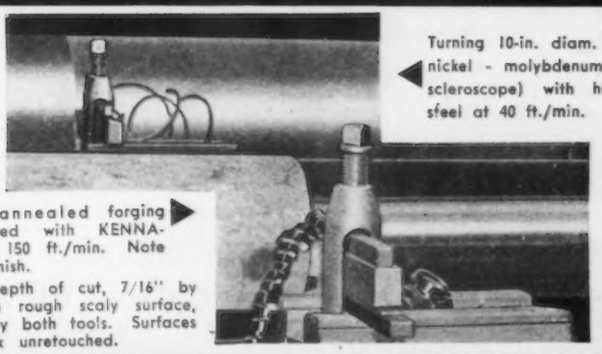
Practice makes Perfection

For Quicker Returns ON YOUR MACHINE TOOL INVESTMENT



Turning 10-in. diam. chromium-nickel - molybdenum bar (46 scleroscope) with high speed steel at 40 ft./min.

Similar unannealed forging being turned with KENNAMETAL at 150 ft./min. Note smoother finish.

Same depth of cut, 7/16" by ¾", on rough scaly surface, taken by both tools. Surfaces of stock unretouched.

Use KENNAMETAL BITS

THE economic value of your machines is no greater than the efficiency of your tool bits. KENNAMETAL-tipped bits may be used at higher speeds (2 to 6 times greater than those of high speed steel) and with less down time for re-grinding and re-setting tools. In the turning job illustrated KENNAMETAL produced a smooth, accurate finish *in one cut* . . . and with 30% less floor to floor time.

KENNAMETAL machines steel heat treated to 550 Brinell while combining roughing and finishing in one operation. Due to its superior strength, KENNAMETAL will take interrupted cuts without breaking and may be ground with chip breaker grooves for safe, convenient disposal of steel chips.

Speed up production and realize quicker returns on your machine tool investment by using KENNAMETAL tools.

McKENNA METALS Co
144 LLOYD AVENUE
LATROBE, PENNSYLVANIA, U.S.A.

Complete information on KENNAMETAL will be sent to interested executives—with no obligations.

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HYDRAULIC PRODUCTION PRESSES

Different Jobs . . . but Farquhar Handles Both

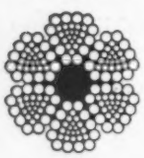
DRAVO Engineering Company specified this 35-ton hydraulic arbor press (left) with swinging tables for specialized work. Farquhar met the requirements. Another set of specifications called for this 2000-ton high speed hydraulic double action press (right) for stamping and drawing—and again Farquhar had the answer.

Write for 24-page Illustrated Bulletin of Farquhar Hydraulic Production Presses. Includes uses, specifications and engineering data for various types. Sent FREE on request.

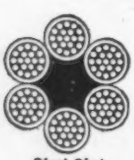
Tell Farquhar engineers about your production problems—they can show *you* how to cut costs with a built-for-the-job Farquhar Hydraulic Press.

A. B. FARQUHAR CO., LTD.
402 DUKE ST., YORK, PA

Style B Flattened Strand


"B" Flattened Strand

Wire Rope Center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There is no guesswork when you use "HERCULES" (Red-Strand) Wire Rope. It is designed and built to do specific jobs better . . . safer . . . more economically. Furnished in a wide variety of constructions so as to be suitable for all purposes—each backed by 81 years of manufacturing experience and close co-operation with users.

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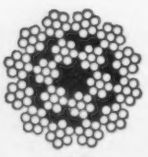
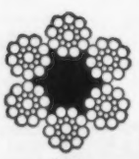

18x7 Non-Rotating

6x19 Filler Wire


6x19 Seale

6x37 Extra Flexible

8x19 Extra Flexible

. . . PIPE LINES . . .

Lone Star Gas Co., Palestine, Tex., plans new 6-in. welded steel pipe line from connection with present system at Buffalo, Tex., to point near College Station, Tex., close to 60 miles, for natural gas transmission. Branch lines will be built to several communities along route, including Centerville, Madisonville, Leona and Normangee, where gas will be furnished for local distribution. Pipe lines, control stations and other operating facilities will be installed. Booster stations will be built for main line service.

United Gas Pipe Line Co., Rusk Building, Houston, Tex., an interest of United Gas Corp., same address, plans welded steel pipe lines in parts of Louisiana, Mississippi and Alabama for natural gas transmission, including about 20 miles of 20-in. and 125 miles of 18-in., latter to follow route along west bank of Mississippi River, where gas will be furnished to several industrial districts. Gas will be secured from natural gas fields in Lafourche and Jefferson Parishes, La., and a steel pipe line gathering system will be installed in that area totaling about 15 miles. Line connection will be made with present system of company near Jackson, Miss., where new compressor station will be built. Booster stations will be located at different points along main line. Work is scheduled to begin soon and will be carried out by company forces. Cost over $2,500,000.

Continental Oil Co., Ponca City, Okla., has arranged for purchase of pipe line system of Crude Oil Pipe Co., and affiliated companies, comprising about 225 miles of lines in Southwestern part of Texas, including Conroe oil field in Montgomery County. Acquisition also includes a 500,000 bbl. bulk oil terminal on deep-water port at Corpus Christi, Tex. Purchasing company plans extensions and improvements in acquired lines, including replacement of about 26 miles of 5½-in. pipe forming part of main line, with new 8-in. welded steel pipe. New line will connect with oil field properties in Duval County, Tex., of Continental company, about 14 miles distant, and other extensions, including pumping stations for booster service and other operating facilities. Executive offices of company are at 60 East Forty-second Street, New York.

Los Angeles Water and Power Bureau, Los Angeles, has low bid from Western Pipe & Steel Co., Los Angeles, for 630 ft., of electric fusion welded steel water pipe, undipped, 40-in. inside diameter, with ⅜-in. wall thickness, 24 to 30 ft. sections, at unit price of $6.96 per ft. (Specifications 3206).

Board of Contracts and Awards, Tacoma, Wash., has low bid from Hydraulic Supply Mfg. Co., 7500 Eighth Street South, Seattle, at $147,797, for 7945 ft. of 30-in. coal tar enameled steel pipe, and 1325 ft. of 18-in. cast iron pipe for new main water line in South Sixty-fourth Street.

Arkansas Fuel Oil Co., Shreveport, La., plans immediate construction of 14-in. welded steel pipe line from connection with Shreveport-Monroe main trunk line system to Bistineau oil field, Bienville Parish, La., for gasoline transmission. New line will connect with natural gasoline plant to be built in latter district by Arkansas company, on which work will begin at once.

$1,000,000 Modernization for Columbia Steel Co.

MILL modernization and improvements entailing an expenditure of $1,000,000 have been announced by the Columbia Steel Co. for its Pittsburgh, Cal., operation. It is announced that when completed the mill will have the most modern products storage area west of the Mississippi River. Operations at the mill have been at maximum capacity for some time.

REINFORCING STEEL

. . . Awards of 7950 tons; 10,750 tons in new projects.

ATLANTIC STATES AWARDS

1900 Tons, Philadelphia, Lit Bros. warehouse, to Bethlehem Steel Co., Bethlehem, Pa., through John McShain, Inc., contractor.

200 Tons, Washington, Navy Yard requisition No. 450, to Joseph T. Ryerson & Son, Inc., Chicago.

160 Tons, Brooklyn, Liebmann Brewery Co. building, to Bethlehem Steel Co., Bethlehem, Pa., through Industrial Engineering Co., contractor.

150 Tons, Buffalo, school, No. 18, to Bethlehem Steel Co., Bethlehem, Pa., through Metzger Construction Corp., contractor.

109 Tons, Montville Township, N. J., Passaic River bridge, to Bethlehem Steel Co., Bethlehem, Pa., through Gray Construction Co., contractor.

WESTERN STATES

4350 Tons, Redding, Cal., Kennett Division Central Valley Project, Bureau of Reclamation (Invitation 33,333-A), to Columbia Steel Co., San Francisco.

500 Tons, Woodland, Wash., Lewis River bridge, to Soule Steel Co., San Francisco.

255 Tons, Fort Bragg, Cal., highway bridge, to Truscon Steel Co., San Francisco.

110 Tons, Climax, Colo., Climax Molybdenum Co., to Republic Steel Corp., Cleveland.

100 Tons, Alameda, Cal., engine test building at air base, to Bethlehem Steel Co., San Francisco.

100 Tons, Bellingham, Wash., postoffice, to Truscon Steel Co., Portland, Ore.

PENDING REINFORCING BAR PROJECTS

ATLANTIC STATES

100 Tons, Dunkirk, N. Y., grade crossing elimination, project P.S.C. 5934; bids close Nov. 9.

SOUTH AND CENTRAL

7000 Tons, Chicago, filtration plant, West Half; bids about Nov. 15.

1000 Tons, Peoria, Ill., housing project.

675 Tons, Dayton, Ohio, torque stand building, Wright Field.

675 Tons, Ironton, Ohio, flood wall.

600 Tons, Enid, Okla., grain elevator.

WESTERN STATES

700 Tons, Portland, Ore., St. Vincent's Hospital East; Ross B. Hammond Co., Inc., Portland, Ore., general contractor.

. . . GREAT BRITAIN . . .

. . . No Allied buying of American steel as yet

LONDON, Oct. 17 (by Cable)—There has been no Allied buying of American steel.

The Continent reports that demand has been generally improved with increasing output and more active overseas interest. Prices have been talked up at least 20s gold.

British works are producing at full capacity mainly for priority business and orders have been placed for delivery up to the end of the year.

There is a strong demand for tin plate especially in the Empire, South America and Portugal up to 28s 6d f.o.b. paid.

Manufacturing has been started by the Toledo Scale Co., Toledo, Ohio, in it new factory, said to be the largest plant in the world for the making of automatic weighing devices. The factory replaces the six old plants, scattered throughout Toledo, which the company had developed in its 40 years of growth.

Good springs are not necessarily expensive. Savings in ultimate use often more than pay for the very slight difference between just a spring—and the right spring. If your springs have been "acting up," Gibson engineers may have the answer. They are always ready for consultation—or for estimates.

Send your specifications to

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PERFORATED METAL

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INDUSTRIAL PERFORATIONS include round, square and special shaped perforations as used in mechanical arts. Our line is comprehensive.

ORNAMENTAL PERFORATIONS as used in architectural grilles, metal furniture, enclosures, cabinets, stoves and for ornamentation. Many attractive and exclusive patterns.

H & K workmanship is unsurpassed.

Any Metal Any Perforation

The Harrington & King PERFORATING CO.

5657 FILLMORE STREET—CHICAGO, ILL. New York Office, 114 Liberty Street

FABRICATED STEEL

. . . Letting in better volume at 18,450 tons as against 12,600 tons last week . . . New projects advanced to 24,700 tons from 14,400 tons a week ago . . . Plate awards total 1440 tons.

NORTH ATLANTIC STATES
AWARDS

2900 Tons, Philadelphia, building for Board of City Trusts, to Bethlehem Steel Co., Bethlehem, Pa.

1600 Tons, New York, Public School No. 118, West 92nd Street, to Bethlehem Fabricators, Inc., Bethlehem, Pa.

1130 Tons, Philadelphia, building for Bell Telephone Co., to Lehigh Structural Steel Co., Allentown, Pa.

660 Tons, Morris County, N. J., Passaic River State bridge, to Bethlehem Steel Co., Bethlehem, Pa.

625 Tons, New Brunswick, N. J., building, for Personal Products Corp., to Ingalls Iron Works Co., Birmingham.

600 Tons, Tonawanda, N. Y., extension to assembly and metal surface building for Curtiss-Wright Corp., to Lackawanna Steel Construction Co., Buffalo.

500 Tons, Providence, R. I., municipal wharf storage building, to Bethlehem Steel Co., Bethlehem, Pa.

280 Tons, New Haven, Conn., library building for Yale University, to Ingalls Iron Works Co., Birmingham.

260 Tons, Etna, Pa., National Supply Co. skelp storage building, to Pittsburgh Bridge & Iron Co., Pittsburgh.

170 Tons, Erie, Pa., Louis Marx Co. plant addition, to R. S. McMannus Steel Construction Co., Buffalo.

130 Tons, Londonderry, Vt., bridge, to American Bridge Co., Pittsburgh.

THE SOUTH

655 Tons, Houston, Tex., garage building, to Mosher Steel Co., Dallas, Tex.

635 Tons, Corpus Christi, Tex., Robert Driscoll Hotel, to Mosher Steel Co., Dallas, Tex.

345 Tons, South Boston, Va., weave shed to Belmont Iron Works, Philadelphia.

250 Tons, Corpus Christi, Tex., Neuces Bay power station, to Alamo Iron Works, San Antonio, Tex.

190 Tons, Ashland, Ky., repairs to Norton furnace, to W. B. Pollock, Youngstown.

110 Tons, Dallas, Tex., Federal Reserve Bank building, to Austin Brothers, Dallas.

CENTRAL STATES

1200 Tons, Chicago, Northwest steam plant for Commonwealth Edison Co., to American Bridge Co., Pittsburgh.

325 Tons, Chicago, contract S-6, subway, to Joseph T. Ryerson & Son, Inc., Chicago.

250 Tons, Detroit, State bridge, to R. C. Mahon Co., Detroit.

235 Tons, Cincinnati, Procter & Gamble power house, to Whitehead & Kales Co., Detroit.

235 Tons, Steubenville, Ohio, Wheeling Steel Corp. cold strip mill, to Pittsburgh Bridge & Iron Co., Pittsburgh.

225 Tons, Lead, S. D., Junior-Senior High School, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

188 Tons, Cleveland, store building in Shaker Heights, to Mooney Iron Works Co., Cleveland, through Mitzel Co., Cleveland.

150 Tons, Brighton, Ohio, rebuilding Chesapeake & Ohio railroad bridge No. 31, to Virginia Bridge Co., Roanoke, Va.

150 Tons, Wadhams, Mich., state bridge, to Yeager Bridge & Culvert Works, Port Huron, Mich.

150 Tons, South Omaha, Neb., substation, to Tulsa Boiler & Machinery Co., Tulsa, Okla.

140 Tons, Fox Lake, Ill., bridge section, to Worden-Allen Co., Milwaukee.

135 Tons, Greene County, Iowa, bridge, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

130 Tons, Lansing, Iowa, Milwaukee Road bridge spans, to American Bridge Co., Pittsburgh.

WESTERN STATES

1500 Tons, Woodland, Wash., Lewis River bridge, to Poole & McGonigle, Portland, Ore.

900 Tons, Sacramento, Cal., office building, to Bethlehem Steel Co., San Francisco.

650 Tons, Downey, Cal., Vultee Aircraft Co. building, to Consolidated Steel Co., Los Angeles.

300 Tons, Los Angeles, overpass, to Bethlehem Steel Co., Los Angeles.

250 Tons, Denver, heating plant, War Department project, to E. Burkhardt & Sons Steel & Iron Works Co., Denver.

150 Tons, Redding, Cal., trusses for concrete conveyors for Shasta Dam contractors, to California Steel Products Co., San Francisco.

140 Tons, Denver, Lowry Field, heating plant, to Denver Steel & Iron Co., Denver.

PENDING STRUCTURAL PROJECTS
NORTH ATLANTIC STATES

1950 Tons, Newark, N. J., bridge over Passaic River on route No. 25; bids close Nov. 10.

2700 Tons, New York, viaduct, 11th Avenue, 33rd-35th Streets for New York Central Railroad.

2500 Tons, Washington, central office building for Bureau of Yards and Docks.

800 Tons, Newport, R. I., assembly building extension for Government.

504 Tons, Johnson City, N. Y., grade crossing elimination, project P.S.C. 8586; bids close Nov. 9.

450 Tons, Burlington, N. J., turbine foundations for Public Service Electric & Gas Co.

358 Tons, Orange County, N. Y., grade separation, project R.C. 4084; bids taken until Nov. 9.

325 Tons, Pittsburgh, factory and warehouse for American Textile Co.

300 Tons, Springville, N. Y., Frye bridge.

250 Tons, Barton, Vt., State bridge.

200 Tons, Tompkins County, N. Y., including 61 tons of reinforcing steel, highway project R.C. 4085.

200 Tons, Dunkirk, N. Y., grade crossing elimination, project P.S.C. 5934; bids close Nov. 9.

195 Tons, Luzerne City, Pa., highway project. Blue Ridge Contracting Co., New Tripoli, Pa., low bidder.

175 Tons, Syracuse, N. Y., building for Easy Washing Machine Corp.

SOUTH AND SOUTHWEST

2200 Tons, Calumet, La., Wax Lake outlet bridge for State.

250 Tons, Butler County, Ky., Indian Camp Creek State bridge.

150 Tons, Galisteo, N. M., State bridge SAP-207-B.

120 Tons, Newport News, Va., repairs to pier No. 2 for Chesapeake & Ohio Railway Co.

CENTRAL STATES

2800 Tons, Santa Fe railroad requirements for bridges in various locations.

2000 Tons. Chicago, Western Avenue improvement project. Board of Local Improvements; bids Oct. 24.

1400 Tons, Burlington railroad bridge requirements in various locations.

450 Tons, Chicago, office, warehouse and shop building for General Electric Realty Corp.

300 Tons, Hammond, Ind., post office and court house, bids Oct. 31.

260 Tons, Crookston, Minn., state highway bridge; bids Oct. 20.

200 Tons. East Sparta, Ohio, addition to kiln for U. S. Quarry Tile Co.

170 Tons, Duluth, Minn., sewage disposal plant.

160 Tons, Brown County, Ohio, Little Miami River state bridge.

120 Tons, Eveleth, Minn., remodeling Hippodrome for city.

110 Tons. Alkali, Ohio, building for Diamond Alkali Co.

100 Tons, Mishawaka, Ind., addition to American Gas & Electric Service Co.

Unstated Tonnage, Newark, Ohio, building for Owens-Corning Fiberglas Corp.; H. K. Ferguson Co., Cleveland, general contractor.

FABRICATED PLATES
AWARDS

400 Tons, San Francisco, tanks for Best Foods Co., to California Steel Products Co., San Francisco.

375 Tons, Baytown, Tex., welded tanks for Humble Oil & Refining Co., to Chicago Bridge & Iron Co., Chicago.

335 Tons, Shreveport, La., steel fascine boxes, to Jones & Laughlin Steel Corp., Pittsburgh.

165 Tons, Brooklyn, pipe, Atlantic Avenue improvement, contract 1, to Alco Products Co., Dunkirk, N. Y.

165 Tons, Jamaica, N. Y., welded pipe, to National Tube Co., Pittsburgh.

Unstated tonnage, Oak Harbor, Ohio, water storage tank, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

PENDING PROJECTS

220 Tons, Bellingham, Wash., 16-in. water line; bids Oct. 19.

SHEET PILING
AWARDS

837 Tons, Los Angeles, sheet piling for United States Engineer (Invitation 509-40-27), to Bethlehem Steel Co., San Francisco.

450 Tons, Cleveland, Cuyahoga River straightening, cuts Nos. 4 and 9, to Bethlehem Steel Co., Bethlehem, Pa., through L. A. Wells Construction Co., Cleveland.

Machine Tool Builders' Index Will Be Revised

CLEVELAND—The National Machine Tool Builders Association has decided to revise its index of monthly orders and until this is accomplished reports will be unavailable to the public. The association this week issued the following explanatory statement:

"Recent conditions in the machine tool industry have emphasized the difficulty of determining what may be regarded at this time as firm orders for the purpose of the industry's index of new business. In view of this the National Machine Tool Builders Association is engaged in constructing a revised index that may more nearly reflect the activity within the industry. The new data may be available within a month or two.

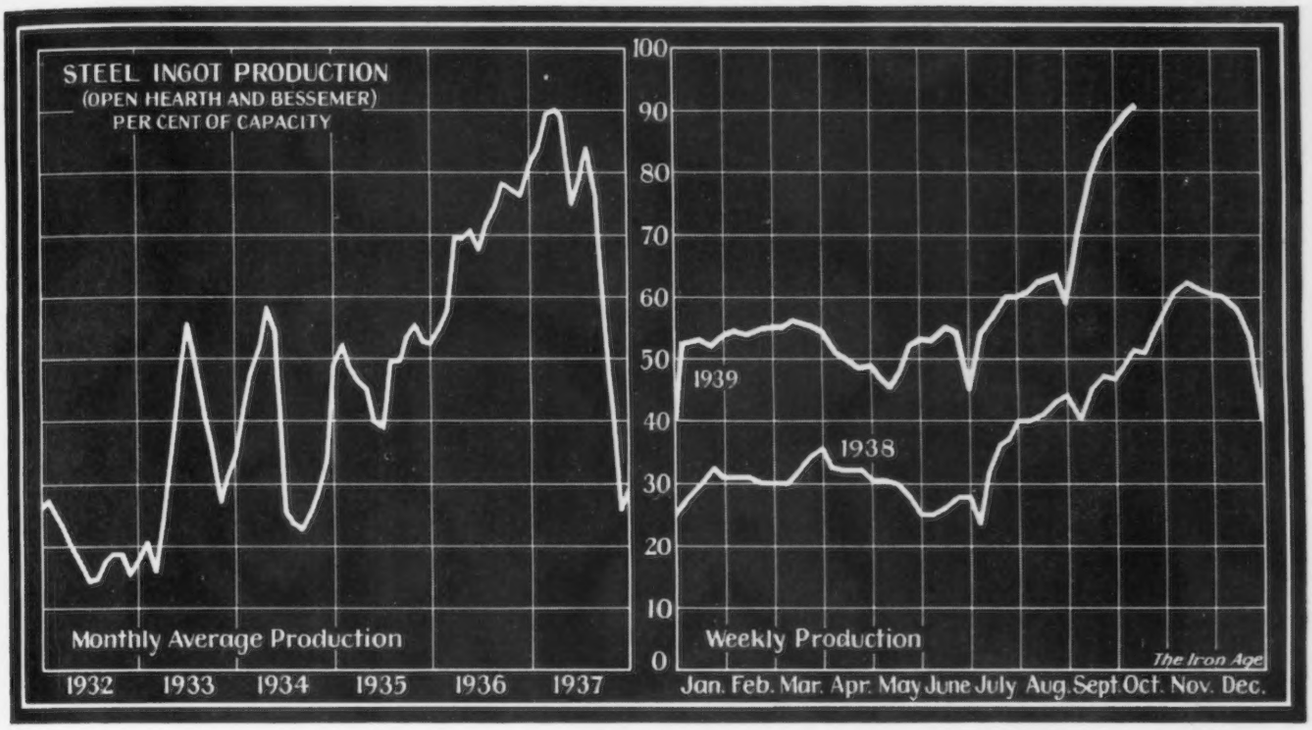
"Indications are that in September both domestic and foreign volume show some increase over August but the uncertainty as to the firm character of pending export business necessarily qualifies what might be regarded as the actual volume of firm orders."

It is understood the proposed new system is undergoing a test this week on the basis of reports from one Middle Western city.

$2,815,339 Third Quarter Profit for Republic

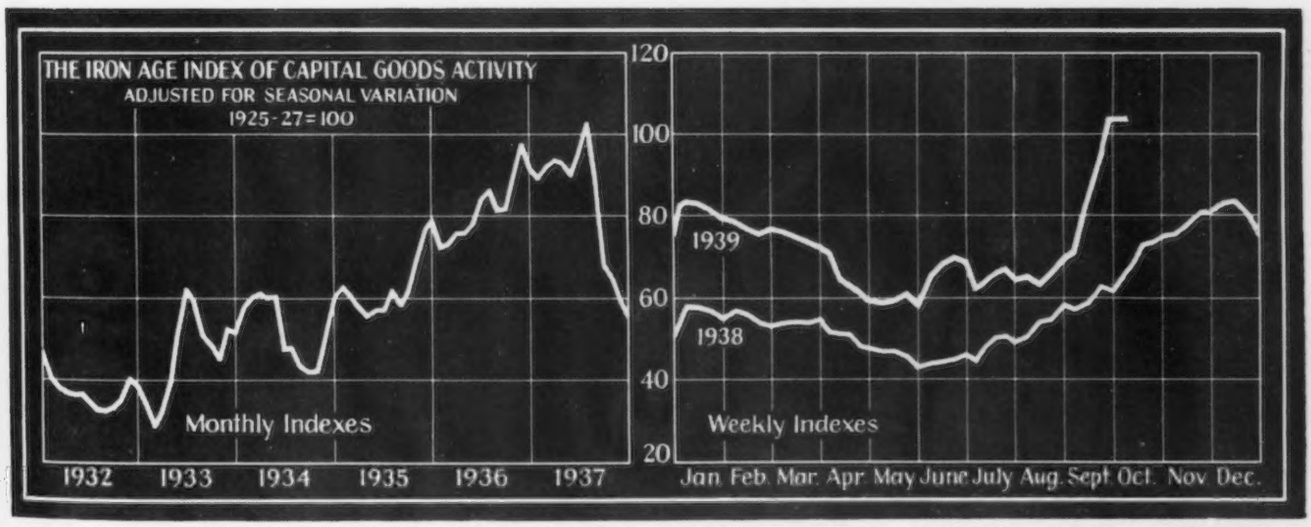
CLEVELAND — Republic Steel Corp. reports a net profit of $2,815,339 for the quarter ending Sept. 30, 1939, against a net loss of $2,387,556 in the corresponding quarter of 1938 and compared with net profit of $550,412 in the quarter ending June 30, 1939. Earnings for the first three quarters of 1939 were $3,898,650.

Ingot Rate Begins to Flatten Out at 91% of Capacity



District Ingot Production, Per Cent of Capacity	Pitts-burgh	Chicago	Valleys	Phila-delphia	Cleve-land	Buffalo	Wheel-ing	Detroit	Southern	S. Ohio River	Western	St. Louis	East-ern	Aggre-gate
CURRENT WEEK	90.0	89.0	94.0	77.0	90.0	92.0	92.0	100.0	90.0	86.5	75.0	79.5	70.0	**91.0**
PREVIOUS WEEK	87.0	87.5	93.0	77.0	90.0	96.0	90.0	100.0	90.0	86.5	65.0	77.5	70.0	**90.0**

New Weakness in Auto Factor Slows Index's Advance



AFTER seven consecutive weeks of unprecedented advances, the first signs of a possible leveling off of THE IRON AGE index of capital goods activity appeared in the past week. The chief cause of the slowdown in the rate of climb was the decline in automobile assemblies due to new labor strikes. The index for the past week, 101.4 represents a gain of only 0.03 points for the week, as compared with a rise of 5.2 points in the preceding week. A feature of the week's statistics was the sharp gain in privately financed heavy construction activity. The dollar volume of the week's awards in this classification was the highest for any week since April 14, 1938, and included a $3,000,000-contract for additions and improvements to plants of the Republic Steel Corp.

	Week Ended Oct. 14	Week Ended Oct. 7	Comparable Week 1938	Comparable Week 1929
Steel ingot production[1]	126.8	124.0	71.6	113.1
Automobile production[2]	138.0	142.1	80.4	120.3
Construction contracts[3]	72.0	70.8	74.5	106.9
Forest products carloadings[4]	66.5	66.6	57.6	115.0
Production and shipments, Pittsburgh District[5]	103.5	102.3	59.2	116.6
Combined index	**101.4**	**101.1**	**68.7**	**114.4**

Sources: 1. THE IRON AGE; 2. Ward's Automotive Reports; 3. *Engineering News-Record;* 4. Association of American Railroads; 5. University of Pittsburgh.

. . . SUMMARY OF THE WEEK . . .

. . . Washington intimates opposition to steel price advances.

° ° °

. . . Moderate increases for first quarter general expectation.

° ° °

. . . Steel scrap prices recede; composite down $1.08.

WHETHER the steel industry will be influenced in its decision on future prices by semi-official intimations from Washington that price advances will be frowned upon and might lead to Government price control cannot be determined on the basis of any information at present available, but it is perhaps significant that Ernest T. Weir, president of the American Iron and Steel Institute, in an address Tuesday evening, declared that price decisions of the steel companies should be made individually on the basis of economic necessity rather than on political threats from Washington.

It is pointed out that steel making costs have been advanced by higher prices on all of the important materials that go into the manufacture of steel. In addition to scrap price advances of around $5 to $6 a ton (on the basis of this week's quotations) there have been increases of 25 per cent on ferromanganese, 17 per cent on tin, 35 per cent on zinc, 18 per cent on fuel oil and 10 per cent on coal.

Economic advisers of the Washington Administration, who are bringing pressure against price advances on steel and who are also watching closely the price movements in scrap, copper, zinc and other important commodities, are represented as being apprehensive of a boom and subsequent disastrous collapse should prices of important commodities get far out of balance. The focusing of attention on the steel industry is based on the contention that it is a key industry whose price policy to a certain extent governs the entire industrial price structure.

Some of the conservative advisers of the Administration are said to take the view that moderate price rises on steel are warranted, while others oppose any price increase at this time. This pressure from Washington on price policies of the steel industry, while not new, is taking a more stringent tone than has heretofore been exhibited.

While confirmable information as to forthcoming price decisions is not yet obtainable, opinion in the trade is that advances, if any, will not exceed $2 or $3 a ton, which steel makers say will not cover their increased costs. However, the major producers seem to be disposed toward a policy of restraint.

Meanwhile some of the smaller steel companies, particularly those making sheets, without having formally advanced their prices, are quoting and getting premium prices for deliveries that they can make in this quarter.

THE hysterical buying of September and early October has been followed by a calmer market, but pressure for shipments is heavy, indicating to steel companies that most of the current production is going into immediate use rather than into inventory. There is also an increasing demand from consumers for first quarter reservations, which are being accepted as heretofore on the basis of the price prevailing at the time of shipment. Some plants have booked the equivalent of several weeks' first quarter output in certain products.

Scrap markets have weakened further as a result of more liberal offerings, which may have been induced by the peace atmosphere of the past two weeks, as well as by the high prices being paid. Steel scrap is off $1 at Pittsburgh, $1.50 at Chicago and 75c. at Philadelphia, reducing THE IRON AGE scrap composite price to $21, down $1.08 from last week's average and $1.50 below the peak of the recent movement. Opinion in the scrap trade is that this is a temporary recession which will be followed by a further upward trend.

As many steel plants are now working at the full limit of practical capacity, the rate of gain in ingot output for the industry as a whole is slowing up, this week's average being estimated at 91 per cent, up one point over last week. Additional blast furnaces are going into production. Beehive coke is again in demand for blast furnace use.

STEEL companies are trying to find places on their schedules for the steel required by the railroads for car repairs and new construction programs. Since Sept. 1 about 700,000 tons of rails and 35,000 freight cars have been ordered. Additional rail orders will total about 300,000 tons, while at least 5000 more cars will soon be ordered.

Shipbuilding companies are taking more steel. Ten additional boats awarded by the Maritime Commission will require about 37,500 tons.

The automobile industry's rapid increase in assemblies has been halted by the Chrysler strike, which is releasing some steel for other consumers.

In Canada the recently constituted War Supply Board is expected to begin the placing of munitions contracts within the next two weeks. The Dominion, with steel capacity of only 2,000,000 tons a year, will need to import considerable steel from the United States. Largest imports by Canada from the United States in recent years were 463,076 tons in 1937.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics

Rails and Semi-finished Steel

Per Gross Ton:	Oct. 17, 1939	Oct. 12, 1939	Sept. 19, 1939	Oct. 18, *1938
Rails, heavy, at mill	$40.00	$40.00	$40.00	$40.00
Light rails: Pittsburgh, Chicago, Birmingham	40.00	40.00	40.00	40.00
Rerolling billets: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point	34.00	34.00	34.00	34.00
Sheet bars: Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point	34.00	34.00	34.00	34.00
Slabs: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point	34.00	34.00	34.00	34.00
Forging billets: Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham	40.00	40.00	40.00	40.00
Wire rods: Nos. 4 and 5, Pittsburgh, Chicago, Cleveland	43.00	43.00	43.00	43.00
Skelp, grvd. steel: Pittsburgh, Chicago, Youngstown, Coatesville, Sparrows Point, cents per lb.	1.90	1.90	1.90	1.90

Finished Steel

Cents Per Lb.:				
Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham	2.15	2.15	2.15	2.25
Plates: Pittsburgh, Chicago, Gary, Birmingham, Sparrows Point, Cleveland Youngstown, Coatesville, Claymont	2.10	2.10	2.10	2.10
Structural shapes: Pittsburgh, Chicago, Gary, Buffalo, Bethlehem, Birmingham	2.10	2.10	2.10	2.10
Cold finished bars: Pittsburgh, Buffalo, Cleveland, Chicago, Gary	2.65	2.65	2.65	2.70
Alloy bars: Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton	2.70	2.70	2.70	2.80
Hot rolled strip: Pittsburgh, Chicago, Gary, Cleveland, Middletown, Youngstown, Birmingham	2.00	2.00	2.00	1.85
Cold rolled strip: Pittsburgh, Cleveland, Youngstown	2.80	2.80	2.80	2.65
Sheets, galv., No. 24: Pittsburgh, Gary, Sparrows Point, Buffalo, Middletown, Youngstown, Birmingham	3.50	3.50	3.50	3.30
Hot rolled sheets: Pittsburgh, Gary, Birmingham, Buffalo, Sparrows Point, Cleveland, Youngstown, Middletown	2.00	2.00	2.00	1.85
Cold rolled sheets: Pittsburgh, Gary, Buffalo, Youngstown, Cleveland, Middletown	3.05	3.05	3.05	2.90
Wire nails: Pittsburgh, Chicago, Cleveland, Birmingham	2.55	2.55	2.40	2.45
Plain wire: Pittsburgh, Chicago, Cleveland, Birmingham	2.60	2.60	2.60	2.60
Barbed wire, galv.: Pittsburgh, Chicago, Cleveland, Birmingham	†3.40	3.40	3.25	3.20
Tin plate, 100 lb. base box: Pittsburgh and Gary	$5.00	$5.00	$5.00	$5.35

*Pittsburgh prices only.
†Applies to 80-rod spools only.
‡Subject to post-season adjustment.

Pig Iron

Per Gross Ton:				
No. 2 fdy., Philadelphia	$24.84	$24.84	$24.84	$22.84
No. 2, Valley furnace	23.00	23.00	23.00	21.00
No. 2, Southern Cin'ti	23.06	23.06	23.06	21.06
No. 2, Birmingham	19.38	19.38	19.38	17.38
No. 2, foundry, Chicago†	23.00	23.00	23.00	21.00
Basic, del'd eastern Pa.	24.34	24.34	24.34	22.34
Basic, Valley furnace	22.50	22.50	22.50	20.50
Malleable, Chicago†	23.00	23.00	23.00	21.00
Malleable, Valley	23.00	23.00	23.00	21.00
L. S. charcoal, Chicago	30.34	30.34	30.34	28.34
Ferromanganese, seab'd carlots	100.00	100.00	100.00	92.50

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	*$22.50*	$23.50	$21.75	$14.75
Heavy melting steel, Phila.	*22.25*	23.00	19.00	14.75
Heavy melting steel, Ch'go	*18.25*	19.75	17.00	13.00
Carwheels, Chicago	*17.50*	18.00	15.75	13.25
Carwheels, Philadelphia	22.25	22.25	19.50	16.75
No. 1 cast, Pittsburgh	22.75	22.75	22.25	15.50
No. 1 cast, Philadelphia	*24.25*	24.75	19.75	16.75
No. 1 cast, Ch'go (net ton)	*16.25*	17.25	15.75	12.25

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	**$5.00**	$4.75	$4.75	$3.75
Foundry coke, prompt	**5.75**	5.50	5.50	4.75

Non-Ferrous Metals

Cents per Lb. to Large Buyers:				
Copper, Electrolytic, Conn.	12.50	12.50	12.00	11.25
Copper, Lake, New York	12.50	12.50	12.00	11.375
Tin (Straits), New York	55.00	**55.00	Nominal	45.25
Zinc, East St. Louis	6.50	6.50	6.25	5.05
Zinc, New York	6.89	6.89	6.64	5.44
Lead, St. Louis	5.35	5.35	5.35	4.95
Lead, New York	5.50	5.50	5.50	5.10
Antimony (Asiatic), N. Y.	14.00	14.00	14.00	14.00

**Nominal.

On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Oct. 17, 1939	2.236c. a Lb.	$22.61 a Gross Ton	$21.00 a Gross Ton
One week ago	2.236	22.61	22.08
One month ago	2.236	22.61	19.25
One year ago	2.211	20.61	14.17
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strip. These products represent 85 per cent of the United States output.	Based on average for basic iron at Valley furnace and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel HIGH	Finished Steel LOW	Pig Iron HIGH	Pig Iron LOW	Steel Scrap HIGH	Steel Scrap LOW
1939	2.286c., Jan. 3	2.236c., May 16	$22.61, Sept. 19	$20.61, Sept. 12	$22.50, Oct. 3	$14.08, May 16
1938	2.512c., May 17	2.211c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.512c., Mar. 9	2.249c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1936	2.249c., Dec. 28	2.016c., Mar. 10	19.73, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.062c., Oct. 1	2.056c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.118c., Apr. 24	1.945c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.953c., Oct. 3	1.792c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.915c., Sept. 6	1.870c., Mar. 15	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.981c., Jan. 13	1.883c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.192c., Jan. 7	1.969c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.228c., Apr. 2	2.192c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.192c., Dec. 11	2.142c., July 10	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 9

. . . THIS WEEK'S MARKET NEWS . . .

NEW BUSINESS

. . . Buying shifts mostly to first quarter delivery

WITH approximately 35,000 freight cars actually ordered since Sept. 1, it is estimated that the total will soon go over the 40,000 mark. More than 700,000 tons of rails have been booked since Sept. 1 and it is reliably estimated that close to 300,000 additional tons will be placed in the near future.

Meanwhile, the amount of fresh business booked subject to price at time of shipment in the PITTSBURGH district has increased moderately in the past week as many consumers attempt to get into position for prompt deliveries during the first quarter.

Shipments from CLEVELAND mills are gaining headway and will be close to the peak in two weeks. Steel is being rationed out to certain users, principally those buying the same type of material that railroads and shipbuilders desire. Considerable confusion surrounds deliveries, as it is impossible to tell what items are needed the most. A number of mills have placed buyers on contract for specified tonnages week by week and if sizes are not forthcoming by a certain advance date, the week's allotment is made available to some other customer. This situation exists in only the most acutely desired products. Here and there, fourth quarter deliveries may still be obtained on a few specialty items.

CHICAGO mills finally are clearing up the order congestion. In some cases last week the tonnage entered was no less though actually the number of orders received was smaller. Tremendous pressure still is being exerted on mills for deliveries. Because this pressure is so great, and so constant, mills believe that consumers really are using most of the material being shipped and that inventories are not being increased to significant proportions.

Railroad buying continues to be of exceptional importance in CHICAGO. This week several more large rail orders were placed or came into the market, and the current week should see several additional buys. Pressure from car builders for plates, shapes, sheets and strip, bars and other materials is strong. Steel warehouses always have enjoyed heavy demand in times of extended mill deliveries, and today is no exception.

Present farm equipment production is being helped along greatly by the new small farm tractors. Should the war continue in Europe, demand for American foodstuffs and rising farm prices probably will result in an enormous call for all agricultural machinery.

Considerable pressure for delivery of steel has developed in Philadelphia over the past 10 days and sales offices there are devoting all their attention to this problem. While on most products mills are booked to capacity to the end of the year, it is still possible to obtain coverage on pipe, cold finished bars, shapes and certain wire products.

STEEL OPERATIONS

. . . Rate for industry advances one point to 91%

WITH all available equipment being brought into service as quickly as possible, the steel industry's average operating rate has gained another point, being estimated this week at 91 per cent against 90 per cent last week.

Maintaining ingot output at the present high level provides many problems for steel makers anxious to avoid extensive repairs or the purchase of new equipment. Minor fluctuations in output are a probability because of unlooked for delays due to production difficulties.

On the finishing mill side, some divisions are still hampered by shortages of billets, slabs, hot bands, skelp or rods, and also by employment problems, while in other rolling mills present capacity estimates may be found too low when the equipment is hard pressed.

Ingot output in the PITTSBURGH district is up three points this week to 90 per cent of capacity, while the WHEELING-WEIRTON district is up two points to 92 per cent.

CHICAGO district mills are operating at 89 per cent of capacity up one and one-half points from a week ago. All mills but one are operating at 100 per cent or more.

Output in the CLEVELAND-LORAIN district is unchanged this week at 90 per cent, while the rate for YOUNGSTOWN and nearby cities has edged up one point to 94 per cent.

PIG IRON

. . . Shipments increase sharply at most producing centers

PIG iron shipments at most points are increasing sharply, with the CHICAGO area running 100 per cent above last month to date, CLEVELAND 25 to 30 per cent above September to the highest level in more than two years, and NEW YORK somewhat heavier but not yet at a pace which might prevent a jam at the end of the year.

At PITTSBURGH, however, shipments and demand show little gain although Carnegie-Illinois Steel Corp. is blowing in a Farrell works blast furnace and Jones & Laughlin Steel Corp. last week blew in its last idle Aliquippa plant stack, making J. & L.'s total 10 out of 11. In the SOUTHERN OHIO district shipments are lighter, with consumers' inventories adequate. Movement of pig iron in the ST. LOUIS area has increased.

Sales in PHILADELPHIA in the past week were extremely light and some sellers have indicated their unwillingness to accept further orders in view of the fact that many merchant furnaces are booked to capacity to the end of the year.

Jobbing foundries in some centers have increased their melting rate and are consuming most of the iron they receive but some larger foundries are putting the bulk of shipments into inventories. Foundries serving the machine tool industry are particularly active.

Foreign inquiries have increased with amounts sought for delivery to Baltic ports ranging to 5000 tons, raising the question of movements through British and German blockades. At BOSTON one British steamer is loading 8000 tons of pig iron for England and four others are waiting to load. The New England foundry melt is increasing rapidly, being near capacity in Connecticut.

PRICES

. . . Government advisers intimate opposition to steel price advances

TO what extent, if any, the steel industry will be influenced in its action on prices for the first quarter by intimations from Government circles in Washington that higher prices

would be frowned upon and might lead to price control legislation cannot be stated with certainty. It is significant, however, that Ernest T. Weir, president of the American Iron and Steel Institute, in an address Tuesday evening before the American Institute of Steel Construction said that price decisions by the steel companies "must be based on economic necessity rather than on political threats from Washington."

A rise in the prices of major steel products is indicated regardless of the views expressed by some of the New Dealers. Such advances, when and if they occur, probably will be moderate, it being the expectation that they will not exceed $2 and $3 a ton, which will not cover the increased costs of making steel, the steel companies state.

Meanwhile, some of the smaller mills, particularly those making sheets, are asking premium prices without having formally announced a price advance. Those makers of plates who recently announced price advances of $5 a ton have been able to obtain the higher prices when prompt delivery is more important to the buyer than price.

Makers of cold finished alloy steel bars have announced a new list of extras effective Oct. 16. Major changes involve the quantity covered by the base price. Twenty thousand pounds and over now takes the base price instead of 10,000 to 19,999 lb. as heretofore. Other upward adjustments have been made in quantity extras, size extras and certain processing extras to conform with recent changes in the hot rolled alloy bar card.

Dealers in sheet and strip seconds are still obtaining very high premiums, up to $30 per ton over the prices formerly in effect. The dealers are paying premium prices to the mills.

Some makers of plates are asking 2.70c. a lb. f.a.s., a price higher than is quoted by members of the Steel Export Association.

Pig iron producers are asking $26 a ton, f.a.s., on export orders.

BOLTS, NUTS AND RIVETS

. . . Production at highest in more than two years

AT CLEVELAND, production and shipments continue at the highest peak in more than two years. Considerable pressure for deliveries is encountered and it is difficult for producers to differentiate between needed items and inventory build-up tonnage. Railroad requirements are growing heavier day by day.

PLATES

. . . Some sales are being made at $5 above published prices

THOSE mills which recently advanced the price of plates $5 a ton are making some sales at the higher level. The larger mills are pretty well filled up for the remainder of the year; hence when fairly prompt delivery is paramount the question of price is not a serious factor with the buyer.

Railroad equipment business is adding to mill tonnage.

Export inquiry for plates has increased, particularly from the Scandinavian countries and South America. Some mills are now quoting 2.70c. a lb., f. a. s., though this price is higher than that quoted by the larger companies on such business as they are willing to take.

REINFORCING BARS

. . . Large tonnage yet to be bought for jobs awarded

BETWEEN 50,000 and 60,000 tons of reinforcing bars are involved in projects awarded to contractors but for which no steel has yet been purchased. Producers in the PITTSBURGH district remain more or less disinterested in concrete bar business, owing to the heavy demand for raw steel supplies from other product departments.

Bethlehem Steel Co. will furnish 1900 tons of bars for the Lit Brothers warehouse in PHILADELPHIA.

In practically all cases, the full merchant bar price is being quoted on new reinforcing bar projects.

The largest reinforcing job in the CHICAGO district, the 12,000-ton city water filtration plant, will be awarded as soon as contract difficulties with the contractor have been worked out. Mills are not seeking reinforcing contracts as actively as two months ago. Now that the reinforcing price is on a parity with the merchant bar quotation, it is probable, however, that mills may be more willing to accept this type of business.

Reinforcing jobbers in the Middle West have sufficient business on hand for the remainder of the year, their problem today being to obtain enough steel to fulfill their contracts.

Griffith Co. and Bent Co., Los Angeles, submitting an estimate of $8,715,358.50, have been awarded the contract for the construction of Friant dam, which is a part of the Bureau of Reclamation's Central Valley project in California. The contract calls for 1650 tons of reinforcing bars, 1900 tons of gates and valves, 1720 tons of tubing and fittings and 1500 tons of pipe, machinery and other metal work.

SHEETS AND STRIP

. . . Bulk of current bookings is for first quarter delivery

FRESH sheet orders subject, of course, to price at time of shipment have been coming in at PITTSBURGH at a fair rate. Some of this business reflects a moderate number of cases where consumers under-specified a month ago with respect to their own requirements.

The sheet and strip price picture has been disturbed recently by domestic political maneuvering on the part of some New Dealers. From the standpoint of increased cost in steel making, at least a moderate advance in prices is indicated but with political pressure being exerted on the steel industry for a continuation of present prices, it remains to be seen what action some producers will take.

Producers at CLEVELAND find it difficult to identify tonnage actually required right away by certain consumers, resulting in occasional difficulty for the users. Demand from the railroad equipment industry continues very good. Stainless capacity is completely engaged through the balance of the year. Dealers in sheet and strip seconds continue to obtain very high prices and are paying premiums to mills for rejects.

Not a great deal of new business is being received by CHICAGO mills. Deliveries constitute the big problem today, and business that requires 1939 delivery is being rejected almost daily. Demands from almost all types of sheet consumers for shipments are very heavy. Sheet sellers believe that stocking of sheets is at a minmum, one or two mills having looked into this question very carefully. In their opinion, therefore, the constant pressure from buyers is justified.

Attention of sheet producers in the SOUTHERN OHIO area is now focused upon production rather than upon demand. Order books have been filled for some weeks for the remainder of the current quarter. Pressure for first quarter bookings continues and mills

in that area indicate that, despite their efforts to discourage a broad first quarter demand, they are now booked approximately two weeks into the new year on terms calling for prices in effect at time of shipment.

SEMI-FINISHED STEEL

. . . Heavy shipments being made
. . . Delivery problems multiply

SHIPMENTS at PITTSBURGH continue heavy and a moderate amount of business has been booked subject to price at time of shipment. Delivery problems have multiplied and some consumers are in urgent need of supplies, although this condition is not general. Price information is highly uncertain, both as to whether or not there will be an advance and as to when such announcement will be made, despite the pressure from consumers.

At CLEVELAND production continues very high but outside shipments are not increased proportionately. Heavy requirements for the export market, forgers and non-integrated producers are still awaiting acceptance.

TUBULAR GOODS

. . . Business still being taken for shipment this year

ALTHOUGH pipe producers are fairly well booked for the remainder of the year, some business can still be taken for shipment before Dec. 31. The volume of new business and shipments is substantially unchanged from a week ago.

WIRE PRODUCTS

. . . Producers now well booked to the end of year

WITH wire producers at PITTSBURGH having booked as much tonnage as can be shipped by the end of this year, all new business on rods and wire is still being taken on the basis of price at time of shipment. Merchant wire sales are slight, owing to a filled up condition of mill books, although some sizes of items can still be shipped and there is still some room on the books for lawn fence bookings.

Production and shipments continue very high at CLEVELAND, although the raw steel and employment factors tend toward retarding production. Capacity is available for fourth quarter in isolated spots such as a few specialty items and coated wires. No room exists at present for additional business in spring wire or rods. Export demand remains much heavier than during August but in proportion to total wire company business it remains about the same.

CHICAGO district sellers continue to receive a fair amount of new business from users of both industrial and merchant wire products. Most lines are sold out for the remainder of the year but there are a few open spots for which orders may be taken. Very little business is being placed on the basis of price at time of shipment, most buyers preferring to wait until prices are announced. Considerable interest is expected from the rural areas for at least another month.

SHIPBUILDING

. . . 10 additional boats awarded will take 37,540 tons of steel

THE Maritime Commission has awarded a $16,996,000 contract to the Federal Shipbuilding & Dry Dock Co., Kearny, N. J., for eight steam-propelled steel cargo ships of the C-2 design. The ships will require an estimated 28,800 tons of steel.

The commission also awarded a $5,500,000 contract to the Moore Dry Dock Co., Oakland, Cal., for two steam-propelled steel cargo ships of the C-3 design. To require a total of 8740 tons of steel, the ships just awarded bring to 139 the total number of vessels contracted for under the commission's program. Of that number, 25 ships have been launched.

TIN PLATE

. . . Operations gain further to 96% . . . Exports a factor

TIN plate operations this week are estimated at 96 per cent of theoretical capacity. The rate may even go higher if some producers decide to bring in additional hot mills. All emphasis is being placed on production and deliveries as material must be shipped by the end of the year, at least that portion consigned to the domestic trade. Export business is no small factor in the present tin plate situation.

RAILROAD BUYING

. . . Cars recently ordered total 35,000 or more . . . 700,000 tons of rails ordered

RELIABLE estimates place the number of freight cars ordered since Sept. 1 at approximately 35,000 and it is expected that within the next several weeks the total will go over 40,000 freight cars. The amount of steel to be utilized for these cars will take well over half a million tons and a substantial amount of additional steel will be used in the various car repair programs now in progress at many railroad shops.

Chicago, Rock Island & Pacific has placed an order for 1000 box cars with Pressed Steel Car Co., approximately 10,000 tons of steel to be utilized.

Great Northern Railroad has purchased 750 75-ton ore cars from Pressed Steel Car Co. and 750 75-ton ore cars from Bethlehem Steel Co. Approximately 30,000 tons of steel will be used in the manufacture of these cars.

Lehigh & New England Railroad has ordered 75 covered hopper cars from American Car & Foundry Co. which will be built at Berwick, Pa.

Louisville & Nashville has ordered 600 hopper cars from Pullman Standard Car Mfg. Co. and 600 hoppers from American Car & Foundry Co., both orders to take about 14,000 tons of steel.

New York, New Haven & Hartford has purchased 250 hopper cars from Pullman Standard Car Mfg. Co., Butler, Pa., and 25 caboose cars from the same company, to be built at the Worcester, Mass., plant and 10 locomotives from American Locomotive Co. About 3300 tons of steel will be required.

Seaboard Airline has purchased 700 box cars from Pullman Standard Car Mfg. Co. to be built at Bessemer, Ala., and requiring about 7000 tons of steel. The same road has bought 100 flat cars from American Car & Foundry, Berwick, Pa., and 100 hopper cars from Bethlehem Steel Co.

Northern Pacific is inquiring for 1000 box, 750 gondola, and 200 hopper cars, which project will take about 22,000 tons of steel.

Delaware & Hudson recently purchased 500 hopper cars from American Car & Foundry and 500 hoppers from Bethlehem Steel Co.

Reading and Central Railroad of N. J. will shortly build 50 hopper cars each. St. Louis - San - Francisco is

planning to rebuild 1500 freight cars in 1940.

Utah Copper Co. has purchased 100 ore cars from Pressed Steel Car Co.

Other pending purchases include 100 hopper cars for Tennessee Central and 250 gondolas for Lehigh Valley.

The Wabash plans to repair and rehabilitate 1694 automobile box cars at a cost of $2,800,000.

The Illinois Central has ordered 10 diesel switch engines from the Electro-Motive Corp., La Grange, Ill.

The St. Louis Southwestern Railway has asked the Federal Court at St. Louis for authority to buy the necessary materials to construct the following: 100 general service coal cars, to cost $253,500; 50 steel flat cars, $51,000; 6 flat cars, $7,538; 12 steel cabooses, $27,020, and 50 50-foot automobile cars, $162,600. The application will be heard on Oct. 20.

The Wheeling & Lake Erie has asked ICC approval to issue $1,200,000 in equipment trust certificates, the proceeds of which would be used in part payment for 400 all-steel self-clearing hopper cars of 60 tons capacity to be built by the Pullman Standard Car Mfg. Co.; 100 of the same type of cars to be manufactured by the Ralston Steel Car Co.; and 200 light weight welded alloy steel cars of 50-ton capacity to be built by the Pullman Standard Car Mfg. Co. Total cost of the equipment was estimated at $1,648,363. The $1,448,363 difference would be paid in cash.

The Florida East Coast Line has applied for authority to sell $1,240,000 in equipment trust certificates to the RFC to finance the purchase of two streamlined trains at a cost of $1,370,000. The equipment will consist of two 2000-hp. diesel single unit electric locomotives to be built by the Electro-Motive Corp. and 14 coaches to be constructed by the E. G. Budd Mfg. Co. Each train of seven coaches, will consist of one combination baggage dormitory coach, one dining car, one tavern lounge observation car, one 50-passenger and three 60-passenger cars.

The Atchison, Topeka & Santa Fe Railroad has applied for authority to issue $8,000,000 in equipment trust certificates to be sold through competitive bidding for the purchase of 2800 freight cars costing $10,143,348. The cars to be built and their builders are: 1800 50-ton box cars, Pullman Standard Car Co.; 300 40-ton refrigerator cars, 100 50-ton box cars, 50 superinsulated 50-ton refrigerator cars, 100 70-ton flat cars, and 50 50-ton gondolas, General American Transportation Corp.; 200 50-ton gondolas, American Car & Foundry Co.; and 200 70-ton ballast cars, Rodger Ballast Car Co. It is estimated that this equipment will require approximately 40,000 tons of steel. Purchase of this equipment was reported in the Oct. 12 issue.

Rails and Accessories

Since Sept. 1 over 700,000 tons of rails have been purchased and it is expected that when remaining inquiries are placed the total will approximate 1,000,000 tons. This rail buying program since Sept. 1 tops, by almost 300,000 tons, the previous season which closed last spring.

New York, New Haven & Hartford Railroad has purchased 15,000 tons of rails divided between Carnegie-Illinois Steel Corp. and Bethlehem Steel Co.

In addition to the 38,500 tons of rails reported last week as purchased from Colorado Fuel & Iron, the Union Pacific Railroad has also bought about 38,500 tons from Carnegie-Illinois Steel Corp. and 10,500 tons from Inland Steel Co.

Chicago, Rock Island & Pacific Railroad has bought approximately 16,000 tons of rails from Carnegie-Illinois Steel Corp., 5000 tons from Inland Steel Co. and 7000 from Colorado Fuel & Iron Co.

It is understood the Baltimore & Ohio Railroad has purchased approximately 25,000 tons of rails, the order having been divided between Carnegie-Illinois Steel Corp., Bethlehem Steel Co. and Inland Steel Co.

It is expected that the New York Central Lines will soon purchase between 50,000 and 60,000 tons of rails.

Erie Railroad has purchased approximately 16,000 tons of rails, the order being divided between Carnegie-Illinois Steel Corp., Bethlehem Steel Co. and Inland Steel Co.

The North Western has ordered 14,000 tons of rails from Carnegie-Illinois Steel Corp. and 6000 tons from Inland Steel Co., a total of 20,000 tons. Bethlehem Steel Co. was awarded 2000 tons for a subsidiary, the Chicago, St. Paul, Minneapolis & Omaha.

The Illinois Central has ordered 2500 tons of rails from Tennessee Coal, Iron & Railroad Co., 2500 tons from Carnegie-Illinois Steel Corp. and 2000 tons from the Inland Steel Co., a total of 7000 tons. This is in addition to the 10,600 tons reported in the Oct. 5 issue of THE IRON AGE.

Orders from the Santa Fe for 91,000 tons of rails should be seen some time this week. The Burlington had not placed an order by the Oct. 15 deadline and is not expected to buy rails at this time.

The Wabash Railway has allocated its purchase of 10,000 tons of 112 lb. rails and the necessary accessories among the Bethlehem Steel Co., Inland Steel Co., and Carnegie-Illinois Steel Co.

The St. Louis-Southwestern has

Weekly Bookings of Construction Steel

	Week Ended				Year to Date	
	Oct. 17, 1939	Oct. 10, 1939	Sept. 19, 1939	Oct. 18, 1938	1939	1938
Fabricated structural steel awards	18,450	12,600	23,100	11,900	786,225	694,375
Fabricated plate awards	1,440	2,020	430	11,790	159,545	112,000
Steel sheet piling awards	1,290	545	0	705	68,915	35,390
Reinforcing bar awards	7,950	9,050	13,700	11,015	386,295	274,625
Total Letting of Construction Steel..	29,130	24,215	37,230	35,410	1,400,980	1,116,390

asked the Federal Court at St. Louis for authority to buy 470 tons of 85 lb. rails.

Missouri-Pacific Railway has been granted authority by the Federal Court at St. Louis to expend $1,555,535 for rail and $1,052,720 for the accessories a total of $2,608,275. Of the total of 38,885 tons of rails, 24,885 tons will be 112 lb. and the balance 90 lb. The rail order was allocated among Carnegie-Illinois Steel Corp., Tennessee Coal, Iron & Railroad Co., Bethlehem Steel Co., Inland Steel Co. and Colorado Fuel & Iron Co. The Missouri Pacific will require 23,995 tons of 112 lb. and 4970 tons of 90 lb.; the Missouri Pacific in Nebraska, 890 tons of 112 lb., and the St. Louis Brownsville & Mexico and International-Great Northern 3000 tons each of 90 lb. Deliveries are to be made before Dec. 31 next.

The Central Railroad of Brazil has placed an order for 17 locomotives with American builders, 10 going to the Baldwin Locomotive Works and seven to the American Locomotive Co., according to the Transportation Division, Department of Commerce. As stated in THE IRON AGE of Oct. 5, the Brazilian carrier also has placed an order for 1000 cars with American builders.

MERCHANT BARS

. . . Bookings are extending into the first quarter

A MODERATE amount of fresh business has been booked at PITTSBURGH, specifically on the basis of price at time of shipment. Such tonnages, however, involve cases where consumers want to protect themselves against long delayed deliveries. Movement of bars to automobile centers is heavy and producers' finishing mills are operating at a rate consistent with the availability of raw steel.

Bar mill schedules at CLEVELAND are into 1940 and still advancing slowly. Inquiries continue very numerous. Price clarification appears to be of minor importance compared with deliveries in the minds of users, but sellers are reluctant to extend bookings very much farther without determining a price.

New extra cards dated Oct. 16 and effective immediately have been issued on cold drawn alloy grades, moved up mostly in size extras to reflect increases announced earlier in the hot rolled alloy list. Principal change is in size extras.

Some cold drawn bar capacity exists for December shipment.

WAREHOUSE BUSINESS

. . . Chicago prices on galvanized sheets are revised

CHICAGO warehouses are now quoting 4.85c. on galvanized sheets for city delivery. Hot rolled bar quantity extras have been revised in the higher brackets, the old reduction of 40c. for quantities of 40,000 lb. and over having been changed to 20c. off on 10,000 lb. and over. The former 30c. allowance for quantities under 40,000 to 10,000 lb. has been replaced by a 10c. reduction for 9999 lb. to 2000 lb. Base of 1999 to 400 lb. and additions for quantities under base are unchanged.

. . . COKE . . .

. . . Pig iron producers seeking supplies of beehive product

DEMAND for pig iron is exceeding actual production. Several merchant pig iron furnaces and some integrated steel furnaces are looking to beehive producers for coke supplies. The number of beehive coke ovens now in use is much less than in 1937, and it is not expected that many more will be brought in unless prices obtained are in excess of current quotations. Over 2500 beehive ovens are operating in the Connellsville and western Pennsylvania regions compared with less than 700 a few months ago.

Prices of furnace beehive coke have advanced from a low of $3.75 a ton to $5 a ton in the past few months.

STRUCTURAL STEEL

. . . Awards and inquiries are in better volume

STRUCTURAL steel lettings at 18,450 tons are in better volume. The outstanding awards are 2900 tons for buildings for the Board of Trusts, Philadelphia; 1600 tons for a public school in New York; 1500 tons for the Lewis River Bridge, Woodland, Wash.; 1200 tons for a steam plant for the Commonwealth Edison Co., Chicago, and 1130 tons for the Bell Telephone Co. building in Philadelphia.

New structural steel projects advanced to 24,700 tons from 14,400 tons last week. Sizable new jobs reported included 4900 tons for a Passaic River bridge at Newark, N. J.; 2800 tons for the Santa Fe Railroad bridge requirements; 2700 tons for a viaduct in New York for the New York Central Railroad; 2500 tons for a central office building in Washington for the Bureau of Yards and Docks; 2200 tons at Calumet, La., for the Wax Lake outlet bridge; 2000 tons at Chicago for the Western Avenue improvement project, and 1400 tons for bridge requirements for the Burlington Railroad.

Structural specifications at PITTSBURGH show little or no change in volume from a week ago. Producers and fabricators expect a seasonal leveling off in the amount of inquiries and awards.

CAST IRON PIPE

Binghamton, N. Y., plans pipe lines for water system in parts of Lamont, Frederick, Thompson and other streets. Cost about $35,000. Work is scheduled to begin soon. J. A. Giles, City Hall, is city engineer.

Ashland, Ky., plans 16-in. pipe from water reservoir on Thirteenth Street to Beech Street for connection with supply line to new Federal prison at Summit, where water will be furnished from city mains. Cost $104,000. Financing has been arranged through Federal aid.

West Milton, Ohio, plans pipe lines for water system and other waterworks installation. Cost about $30,000. Bond issue in that amount will be voted at general election, Nov. 7.

Greybull, Wyo., will take bids on or about Oct. 28 for main pipe line from source of water supply at Canton, Wyo., to city limits, about 17½ miles, with alternate bids on steel pipe. Bond issue of $235,000 has been voted for this and other waterworks installation. T. H. Baldwin, Cheyenne, Wyo., is consulting engineer.

Poynette, Wis., asks bids until Oct. 23 for 2000 ft. of 8-in. and 8000 ft. of 6-in. pipe for water system; also for fittings and specials, fire hydrants, gate valves, etc. General Engineering Co., Portage, Wis., is consulting engineer.

Council Grove, Kan., plans about four miles of 8-in. pipe for main water supply from new dam to be built across Canning Creek to connection with present filter station; also distribution line extensions and other waterworks installation. Bond issue of $72,000 has been voted to make total fund of $210,000 available for project. S. A. Sulentic, New England Building, Topeka, Kan., is consulting engineer.

Summerfield, Kan., plans pipe line extensions and replacements in system, and other waterworks installation. Cost about $37,000. Financing is being arranged through Federal aid. Paulette & Wilson, 1006 Kansas Avenue, Topeka, Kan., and Public Utility Building, Salina, Kan., are consulting engineers.

Hawthorne, Cal., plans about 3700 ft. of 14-in. pipe for main line extension to site of new plant of Northrop Aircraft, Inc., near 120th Street and Crenshaw Boulevard, where water will be furnished. Fund of $25,000 has been arranged for this and other waterworks installation.

United States Cast Iron Pipe & Foundry Co. has been awarded 1000 tons of 6, 8 and 12-in. pipe for Navy air base of Alameda, Cal.

Newport Beach, Cal., has awarded 100 tons of 6 and 8 in. to American Cast Iron Pipe Co., San Francisco.

San Diego, Cal., has awarded 1500 tons of pipe to American Cast Iron Pipe Co. for a 30-in. line 9600 ft. long.

Whittier, Cal., has awarded 265 tons of 10 and 24 in. pipe to American Cast Iron Pipe Co.

Coulee City, Wash., has placed 203 tons of 4, 6, 8 and 10 in. pipe with United States Cast Iron Pipe & Foundry Co.

Los Angeles Department of Water and Power opened bids Oct. 17 for 2200 tons of 6, 8 and 12-in. pipe.

. . . NON-FERROUS . . .

. . . Buyers study foreign developments for key to future trend . . . Demand is generally less insistent, but fair interest in futures still in evidence . . . Some copper sold abroad at 12.50c., f.a.s.

NEW YORK, Oct. 17—With requirements for the fourth quarter well covered, the foreign situation is receiving close study by consumers here for a possible clue to future price trends. There is little question that a radical change in conditions abroad would find sharp reflection in the non-ferrous markets in this country. Fabricating activities here are slowly expanding and it appears that a large part of current shipments is going directly into production, with only a minor portion finding its way to stock piles. Efforts are also being made to increase output of the prime metal, making for more orderly markets. Copper buying in the past week was relatively light, with the bulk of the purchases calling for January shipment. Prices on this business continue unchanged at 12.50c. per lb., Connecticut Valley, but premiums of up to 10 points have been paid for prompt shipment in the open market. Export inquiry was fairly active all week, with some business having been booked at around 12.50c. per lb., f.a.s.

Lead

Consumer demand in the past week, while not quite as insistent as in the preceding period, was still in good volume. The bulk of the current interest is in November delivery, but scattered October carlots are still being booked. The easing in buying has had no noticeable influence on the pressure for shipment, as consumers strive to obtain possession of the physical metal as a hedge against a possible future shortage, which producers insist is most unlikely. Quotations remain firm and unchanged at 5.50c. per lb., New York.

Zinc

Sales in the past week declined to 3100 tons from 5800 tons in the previous week, while shipments dropped to 6000 tons from 8400 tons. The tapering in buying was accompanied by a disposition on the part of sellers to offer metal more freely. Quotations, however, remain firmly established at 6.89c. per lb., New York. Unfilled orders for brass and bronze ingots and billets on the books of members of Non-Ferrous Ingot Metal Institute on Oct. 1 totaled 22,499 tons, the highest since March, 1937.

Tin

The lack of new supplies from England and the East continues to lend the market a very firm tone. There was a fair amount of tin sold during the past week, but the volume done did not approach what could be sold if importers were able to obtain sufficient metal from the primary sources. The stalemate in the Eastern market persists. Quotations on straits were nominally 55c. per lb., New York, all week.

NON-FERROUS PRICES

Cents per lb. for early delivery

	Oct. 11	Oct. 12	Oct. 13	Oct. 14	Oct. 16	Oct. 17
Copper, Electrolytic[1]	12.50	12.50	12.50	12.50	12.50	12.50
Copper, Lake	12.50	12.50	12.50	12.50	12.50	12.50
Tin, Straits, New York	Nominally 55c.					
Zinc, East St. Louis[2]	6.50	6.50	6.50	6.50	6.50	6.50
Lead, St. Louis[3]	5.35	5.35	5.35	5.35	5.35	5.35

[1] Delivered Conn. Valley. Deduct ¼c. for New York delivery. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Warehouse Prices

Cents per lb., Delivered

	New York	Cleveland
Tin, Straits pig	57.00c.	Nominal
Copper, Lake	13.50c.	13.625c.
Copper, electro	13.25c.	13.625c.
Copper, castings	12.875c.	13.375c.
*Copper sheets, hot-rolled	20.87c.	20.87c.
*Yellow brass sheets	19.06c.	19.06c.
*Seamless brass tubes	21.81c.	21.81c.
*Seamless copper tubes	21.37c.	21.37c.
*Yellow brass rods	15.23c.	15.23c.
Zinc slabs	7.875c.	8.125c.
Zinc sheets, No. 9 casks	12.00c.	12.10c.
Lead, American pig	6.50c.	6.125c.
Lead, bar	8.95c.	8.75c.
Lead, sheets, cut	8.50c.	8.50c.
Antimony, Asiatic	16.00c.	17.00c.
Alum., virgin, 99 per cent plus	21.50c.	22.50c.
Alum., No. 1 remelt., 98 to 99 per cent	19.00c.	19.50c.
Solder, ½ and ½	Nominal	Nominal
Babbitt metal, commercial grade	Nominal	Nominal

*These prices, which are also for delivery from Chicago warehouses, are quoted with the following percentages allowed off for extras: on copper sheets, 33 1/3; on brass sheets and rods, 40; on brass tubes, 33 1/3, and copper tubes, 40.

Old Metals

Cents per lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators. Selling prices are those charged to consumers after the metal has been prepared for their uses.

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	10.125c.	10.75c.
Copper, hvy. and wire	9.125c.	9.50c.
Copper, light and bottoms	8.125c.	8.625c.
Brass, heavy	5.50c.	6.00c.
Brass, light	4.625c.	5.375c.
Hvy. machine composition	9.25c.	10.125c.
No. 1 yel. brass turnings	5.25c.	5.75c.
No. 1 red brass or compos. turnings	9.125c.	9.625c.
Lead, heavy	4.375c.	4.75c.
Cast aluminum	8.50c.	9.50c.
Sheet aluminum	14.50c.	15.50c.
Zinc	3.125c.	4.375c.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 20c.-21c. a lb.; No. 12 remelt No. 2 standard, 19c.-19.50c. a lb. NICKEL, electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt: Asiatic, 14c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $150 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 13.75c. a lb.

Westinghouse May Expand To Serve Plane Industry

CHICAGO—The Westinghouse Electric & Mfg. Co., Pittsburgh, may soon begin to concentrate more heavily on the making of electrical parts and equipment for the aviation industry, A. W. Robertson, chairman, said here early this week. A new plant, for which the site is not yet decided, may be necessary, Mr. Robertson said. Foreign business is not responsible for the management's decision to expand, he added. Mr. Robertson said he believed no serious recession in business would be seen if peace were to come in Europe, and that some businesses might even experience advances.

IRON AND STEEL SCRAP

. . . Composite price declines $1.08 to $21.00 as softness develops all over the country . . . Material coming out freely.

OCT. 17—The reaction begun last week from the rapid climb that scrap prices took beginning early in September continues this week. Most prices have declined, on the average about $1 from last week. Mill buying has practically ceased for the moment, but the flow of material into consumption is at flood tide due to the prompt release of material when the reaction first set in. Some small tonnage purchases were made in Chicago this week, but they had the effect of lowering the market there $1.50. At Pittsburgh, No. 1 steel is off $1, chiefly of the basis of broker coverages on old orders. The average at Philadelphia is nominally down 75c., although no new mill sales are reported. As a result of these declines THE IRON AGE composite figure drops this week to $21, down $1.08 from last week's average and $1.50 from the highest point of the year registered on Oct. 3. This reaction compares with an advance of $6.88 in the preceding four weeks.

Export buying prices continue firm, although there has been no new buying on the part of the Japanese and shipments to Europe are still restricted. Canadian prices advanced sharply the past week.

Pittsburgh

The market is still going through a corrective period, and although technically stronger than a week ago, many grades of scrap are quotably lower this week. No. 1 heavy melting steel this week is quoted at $22 to $23 a ton, down $1 from last week's average. A dollar spread is being maintained in this grade and several others because of the numerous factors present in the current market. Some brokers have offered No. 1 steel into consumption at around $22, while sales have been made in the past week at $23 a ton. Brokers are paying $22 to $22.50 in covering No. 1 orders, and there have been small amounts of distress No. 1 purchased at less than $22 a ton. Railroad heavy melting quotations are also down this week and a slight leveling off has occurred in railroad specialties. Meanwhile, with steel ingot ouput being maintained at record levels and with some consumers believed to have made a dent in surplus scrap stocks, no precipitous decline in scrap prices in the near future is anticipated. On the other hand, neither does a sharp upward climb appear imminent.

Chicago

Some small purchases of heavy melting were made early this week at $18.50 by a large district mill, establishing a price of $18 to $18.50. Brokers are not yet able to buy for less than $18.25 and not freely at that level, but it is likely that $18 will bring out steel by the week end. With the easing in prices has come a flood of scrap into this district, the leading buyer being forced to suspend shipments because of the car congestion at the mill. Trading here has been light for the past week because of this traffic jam, and will continue so until normal shipping again is possible. It is generally felt that this market's softness is only temporary and that either further advances or stabilization somewhere around current quotations will be seen within a short time.

Philadelphia

A cessation of mill buying and the release of fairly substantial tonnages by the smaller dealers has taken the edge off the market here, making it unlikely that any consumer would be required to pay $23 for No. 1 steel today. This grade is, consequently, being marked down to a nominal $22 to $22.50. Cast grades are also somewhat weaker, partly through the lessened demand because of the increased use of pig iron, and partly through an easing in the tight supply situation which has existed over the past month. Several lots of chemical borings have been purchased at prices ranging from $14 to $15, the higher price being paid for a selected lot. A cargo of about 2000 tons, most of which was accumulated slowly over the past six years, will be loaded this week for shipment to Japan.

Cleveland

Scrap remains off from the peak reached early this month, but the reaction simply results from too fast an advance, the unsettled European and Congressional situation, the quick action by independent steel buyers and the fact that high prices tend to open up distant reservoirs. Receipts by vessel are steady here, averaging a boat per day at the start of this week. Open-hearth operations continue around 90 per cent. No. 1 heavy melting steel is quoted down $1 per ton this week, at $19 to $19.50.

Youngstown

Prices remain nominal and not as strong as they were two weeks ago. Shipments to consuming mills are going forward steadily. Dealers can buy more cheaply. No. 1 heavy melting steel is quoted down $1 this week, at $20.50 to $21.

Buffalo

An easier tone is apparent in the market this week. All mills have appreciable stocks on hand, and one of the largest consumers in this district has temporarily left the market. Shipments have been restricted at another mill. Approximately 9000 tons of scrap arrived in port this week on an old, out-of-district sale.

St. Louis

The scrap iron market in St. Louis has quieted down considerably in the last week, and prices of melting grades have declined from 25c. to $1.50 a ton. The declines are due to a heavy movement of material to this market brought on by higher prices offered by dealers. The restriction because of congested shipments by the steel mills of recent purchases and the lack of buying. One district mill has instructed that shipments be withheld for two weeks. It is expected there will be no buying for another month. Railroad lists: Southern, 4700 tons; Chicago, Rock Island & Pacific, 4700 tons; Missouri Pacific, 600 tons, and Chicago & Western Indiana, 480 tons.

Cincinnati

As "peace talks" lessened the past week, the district scrap market tended to a firmer tone. While mills are still reluctant to pay higher prices, dealers feel that present levels are justified by business activity generally. Offerings are being well absorbed and reports of good prices on the recent L. & N. list have tended to hold dealers' bids at present published levels.

New York

Although the market is definitely softer here, brokers have not lowered their buying prices, preferring not to disturb the flow of scrap material, now coming out freely. The Japanese have not bought any material for three or four weeks, but the vessel situation is much improved and shipments on old orders are going forward much faster. On the other hand, shipments to Europe are still restricted, no convoy systems having been developed for British destination, and ship owners are equally reluctant to chance a boatload of scrap to neutral Italy.

Detroit

Sympathetically with the softness in other markets, dealer buying prices are lower here this week, No. 1 steel being off $1 and hydraulic bundles 50c. from last week's quotations. Other items are similarly affected.

Boston

Conflicting price trends are noted. The weakness of No. 1 heavy melting steel in the Pittsburgh territory has checked the upswing in such materials as turnings, blast furnace, breakable cast, stove plate, etc., and has lowered prices for Nos. 1 and 2 steel for yard storage. In contrast, the market for export material is a shade firmer because of a growing difficulty in obtaining No. 1 steel, and prospects of a greater pinch due to requirements for New England steel mills, all of which are now operating close to capacity.

Toronto

Canadian scrap prices moved up from 25c. to more than $2 per ton during the week, with all items on the list affected by the new quotations. The advance in dealers' buying prices was put into effect with the idea of bringing out larger offerings and to some extent the move has been successful. No shortage of iron or steel scrap is reported and dealers are meeting all commitments on schedule. Consumers continue to order on a minimum basis and booking to the end of the year has been scarce. Short term contracts from consumers continue the rule and it is expected this policy will continue until a pinch is felt.

Iron and Steel Scrap Prices

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$22.00 to $23.00
Railroad heavy melting	24.50 to 25.00
No. 2 heavy melting	20.50 to 21.00
Scrap rails	24.50 to 25.00
Rails 3 ft. and under	26.50 to 27.00
Comp. sheet steel	22.00 to 23.00
Hand bundled sheets	21.00 to 22.00
Heavy steel axle turn.	20.00 to 21.00
Machine shop turnings	14.00 to 15.00
Short shov. turnings	17.50 to 18.00
Mixed bor. & turn.	13.50 to 14.00
Cast iron borings	13.50 to 14.00
Cast iron carwheels	21.50 to 22.00
Heavy breakable cast.	19.00 to 19.50
No. 1 cupola cast	22.50 to 23.00
RR. knuckles & coup.	27.50 to 28.00
Rail coil springs	27.50 to 28.00
Rail leaf springs	27.50 to 28.00
Rolled steel wheels	27.50 to 28.00
Low phos. billet crops	29.50 to 30.00
Low phos. punchings	25.50 to 26.00
Low phos. heavy plate	26.00 to 27.00
Railroad malleable	24.50 to 25.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$22.00 to $22.50
No. 2 hvy. mltng. steel	20.00
Hydraulic bund., new	22.00 to 22.50
Hydraulic bund., old	18.00 to 18.50
Steel rails for rolling	21.50 to 22.20
Cast iron carwheels	22.00 to 22.50
Hvy. breakable cast	20.50 to 21.00
No. 1 cast	24.00 to 24.50
Stove plate (steel wks)	17.50 to 18.00
Railroad malleable	22.00
Machine shop turn	14.00 to 14.50
No. 1 blast furnace	12.50 to 13.00
Cast borings	12.50 to 13.00
Heavy axle turnings	17.00 to 17.50
No. 1 low phos. hvy	25.50 to 26.00
Couplers & knuckles	26.00
Rolled steel wheels	26.00
Steel axles	24.50 to 25.00
Shafting	24.50 to 25.00
Spec. iron & steel pipe	17.00 to 17.50
No. 1 forge fire	16.50 to 17.00
Cast borings (chem.)	14.00 to 14.50

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy. mltng. steel	$18.00 to $18.50
Auto. hvy. mltng. steel alloy free	17.00 to 17.50
No. 2 auto steel	14.00 to 14.50
Shoveling steel	18.00 to 18.50
Factory bundles	17.50 to 18.00
Dealers' bundles	16.50 to 17.00
Drop forge flashings	16.50 to 17.00
No. 1 busheling	17.00 to 17.50
No. 2 busheling, old	8.00 to 8.50
Rolled carwheels	21.00 to 21.50
Railroad tires, cut	21.25 to 21.75
Railroad leaf springs	20.50 to 21.00
Steel coup. & knuckles	20.50 to 21.00
Axle turnings	17.00 to 17.50
Coil springs	21.50 to 22.00
Axle turn. (elec.)	19.00 to 19.50
Low phos. punchings	22.00 to 22.50
Low phos. plates 12 in. and under	21.50 to 22.00
Cast iron borings	11.00 to 11.50
Short shov. turn	12.00 to 12.50
Machine shop turn	11.00 to 11.50
Rerolling rails	21.00 to 21.50
Steel rails under 3 ft.	21.50 to 22.00
Steel rails under 2 ft.	22.00 to 22.50
Angle bars, steel	21.00 to 21.50
Cast iron carwheels	17.25 to 17.75
Railroad malleable	21.00 to 21.50
Agric. malleable	17.00 to 17.50
	Per Net Ton
Iron car axles	$23.75 to $24.25
Steel car axles	22.00 to 22.50
Locomotive tires	17.00 to 17.50
Pipes and flues	14.00 to 14.50
No. 1 machinery cast	16.00 to 16.50
Clean auto. cast	16.50 to 17.00
No. 1 railroad cast	15.50 to 16.00
No. 1 agric. cast	14.00 to 14.50
Stove plate	12.00 to 12.50
Grate bars	12.00 to 12.50
Brake shoes	13.50 to 14.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$20.50 to $21.00
No. 2 hvy. mltng. steel	19.00 to 19.50
Low phos. plate	23.50 to 24.00
No. 1 busheling	19.50 to 20.00
Hydraulic bundles	20.00 to 20.50
Machine shop turn	12.50 to 13.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$19.00 to $19.50
No. 2 hvy. mltng. steel	18.00 to 18.50
Comp. sheet steel	18.50 to 19.00
Light bund. stampings	15.50 to 16.00
Drop forge flashings	18.25 to 18.75
Machine shop turn	12.00 to 12.50
Short shov. turn	12.75 to 13.25
No. 1 busheling	18.25 to 18.75
Steel axle turnings	17.00 to 17.50
Low phos. billet and bloom crops	24.00 to 24.50
Cast iron borings	12.50 to 13.00
Mixed bor. & turn	12.50 to 13.00
No. 2 busheling	12.50 to 13.00
No. 1 cupola cast	21.50 to 22.00
Railroad grate bars	14.50 to 15.00
Stove plate	14.50 to 15.00
Rails under 3 ft.	24.00 to 24.50
Rails for rolling	22.75 to 23.25
Railroad malleable	21.25 to 21.75

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$21.00 to $21.50
No. 2 hvy. mltng. steel	19.00 to 19.50
Scrap rails	21.00 to 21.50
New hvy. b'ndled sheets	18.50 to 19.00
Old hydraul. bundles	17.50 to 18.00
Drop forge flashings	19.00 to 19.50
No. 1 bushelings	19.00 to 19.50
Machine shop turn	11.50 to 12.00
Shov. turnings	15.00 to 15.50
Mixed bor. & turn	11.50 to 12.00
Cast iron borings	11.50 to 12.00
Knuckles & couplers	25.00 to 26.00
Coil & leaf springs	25.00 to 26.00
Rolled steel wheels	25.00 to 26.00
No. 1 machinery cast	20.00 to 20.50
No. 1 cupola cast	19.00 to 19.50
Stove plate	16.00 to 16.50
Steel rails under 3 ft.	23.50 to 24.00
Cast iron carwheels	21.00 to 21.50
Railroad malleable	21.50 to 22.00

ST. LOUIS

Dealers' buying prices per gross ton delivered to consumer:

Selected hvy. melting	$17.75 to $18.25
No. 1 hvy. melting	16.50 to 17.00
No. 2 hvy. melting	15.75 to 16.25
No. 1 locomotive tires	17.50 to 18.00
Misc. stand. sec. rails	18.00 to 18.50
Railroad springs	21.50 to 22.00
Bundled sheets	13.00 to 13.50
No. 1 busheling	14.00 to 14.50
Cast bor. & turn	8.00 to 8.50
Machine shop turn	8.00 to 8.50
Heavy turnings	12.50 to 13.00
Rails for rolling	20.50 to 21.00
Steel car axles	21.00 to 21.50
No. 1 RR. wrought	12.00 to 12.50
No. 2 RR. wrought	16.50 to 17.00
Steel rails under 3 ft.	21.50 to 22.00
Steel angle bars	20.00 to 20.50
Cast iron carwheels	20.00 to 20.50
No. 1 machinery cast	17.50 to 18.00
Railroad malleable	17.00 to 17.50
No. 1 railroad cast	15.00 to 15.50
Stove plate	11.00 to 11.50
Grate bars	10.50 to 11.00
Brake shoes	12.50 to 13.00

CINCINNATI

Dealers' buying prices per gross ton at yards:

No. 1 hvy. mltng. steel	$16.50 to $17.00
No. 2 hvy. mltng. steel	14.50 to 15.00
Scrap rails for mltng.	21.00 to 21.50
Loose sheet clippings	12.00 to 12.50
Hydrau. b'ndled sheets	16.00 to 16.50
Cast iron borings	6.50 to 7.00
Machine shop turn	7.50 to 8.00
No. 1 busheling	12.50 to 13.00
No. 2 busheling	5.50 to 6.00
Rails for rolling	22.00 to 22.50
No. 1 locomotive tires	18.00 to 18.50
Short rails	23.50 to 24.00
Cast iron carwheels	18.00 to 18.50
No. 1 machinery cast	19.50 to 20.00
No. 1 railroad cast	18.00 to 18.50
Burnt cast	10.75 to 11.25
Stove plate	10.75 to 11.25
Agricul. malleable	16.00 to 16.50
Railroad malleable	19.00 to 19.50
Mixed hvy. cast	17.00 to 17.50

BIRMINGHAM

Per gross ton delivered to consumer:

Hvy. melting steel	$13.00
Scrap steel rails	15.00
Short shov. turnings	8.50
Stove plate	9.50
Steel axles	18.50
Iron axles	18.50
No. 1 RR. wrought	12.50
Rails for rolling	18.00
No. 1 cast	16.00
Tramcar wheels	16.00

DETROIT

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. industrial steel	$15.50 to $16.00
No. 2 hvy. mltng. steel	15.00 to 15.50
Borings and turnings	9.50 to 10.00
Long turnings	8.50 to 9.00
Short shov. turnings	12.00 to 12.50
No. 1 machinery cast	16.00 to 16.50
Automotive cast	17.50 to 18.00
Hvy. breakable cast	14.00 to 14.50
Stove plate	11.00 to 11.50
Hydraul. comp. sheets	18.00 to 18.50
New factory bushel	15.00 to 15.50
Sheet clippings	13.00 to 13.50
Flashings	14.50 to 15.00
Low phos. plate scrap	16.50 to 17.00

NEW YORK

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$16.50 to $17.00
No. 2 hvy. mltng. steel	13.50 to 14.50
Hvy. breakable cast	16.50 to 17.00
No. 1 machinery cast	16.50 to 17.50
No. 2 cast	15.50 to 16.00
Stove plate	13.50 to 14.50
Steel car axles	19.00 to 20.00
Shafting	19.00 to 20.00
No. 1 RR. wrought	14.00 to 15.00
No. 1 wrought long	12.50 to 13.00
Spec. iron & steel pipe	13.50 to 14.00
Rails for rolling	19.00 to 20.00
Clean steel turnings*	9.00 to 10.00
Cast borings*	8.00 to 9.00
No. 1 blast furnace	8.00 to 9.00
Cast borings (chem.)	Nominal
Unprepared yard scrap	9.00 to 9.50
Light iron	5.00 to 5.50

Per gross ton, delivered local foundries:

No. 1 machin. cast†	$18.50 to $19.00
No. 2 cast†	15.50 to 16.00

* $1.50 less for truck loads.
† Northern N. J. prices are $2 to $2.50 higher

BOSTON

Dealers' buying prices per gross ton

Breakable cast	$15.50 to $15.75
Machine shop turn	9.00 to 9.25
Mixed bor. & turn	7.50 to 7.75
Bun. skeleton long	12.50 to 12.75
Shafting	19.00 to 19.25
Cast bor. chemical	6.00 to 6.50

Per gross ton delivered consumers' yards:

Textile cast	$18.00 to $19.00
No. 1 machine cast	18.00 to 19.00

Per gross ton delivered dealers' yards:

No. 1 hvy. mltng steel	$15.75 to $16.25
No. 2 steel	14.75 to 15.25

PACIFIC COAST

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$14.35
No. 2 hvy. mltng. steel	13.35

CANADA

Dealers' buying prices at these yards, per gross ton:

	Toronto	Montreal
No. 1 hvy. mltng. steel	$10.50	$10.00
No. 2 hvy. mltng. steel	9.25	8.75
Mixed dealers steel	8.25	7.75
Drop forge flashings	9.75	9.25
New loose clippings	6.00	5.50
Busheling	5.50	5.00
Scrap pipe	7.00	6.50
Steel turnings	6.00	5.50
Cast borings	5.50	5.00
Machinery cast	18.00	18.50
Dealers cast	17.00	16.50
Stove plate	12.00	11.50

EXPORT

Dealers' buying prices per gross ton:

New York, truck lots, delivered, barges

No. 1 hvy. mltng steel	$17.00 to $17.50
No. 2 hvy. mltng. steel	15.50 to 16.50
No. 2 cast	15.00 to 15.50
Stove plate	13.50 to 14.50

Boston on cars at Army Base or Mystic Wharf

No. 1 hvy. mltng. steel	$18.00 to $18.50
No. 2 hvy. mltng. steel	17.00 to 17.50
Rails (scrap)	18.25 to 18.50

Philadelphia, delivered alongside boats, Port Richmond.

No. 1 hvy. mltng. steel	Nominal
No. 2 hvy. mltng. steel	Nominal

PRICES ON FINISHED AND SEMI-FINISHED IRON AND STEEL

Steel prices on these pages are base prices only and f.o.b. mill unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases the amount of freight which must be absorbed in order to meet competition

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (Rerolling only). Prices delivered Detroit are $2 higher. F.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Gross Ton
Pittsburgh, Chicago or Cleveland	$43.00
Worcester, Mass.	45.00
Birmingham	43.00
San Francisco	52.00

Rods over 9/32 in. or 47/64 in., inclusive, $5 a ton over base.

SOFT STEEL BARS

	Base per Lb.
Pittsburgh, Chicago, Gary, Cleveland, Buffalo and Birmingham	2.15c.
Detroit, delivered	2.25c.
Duluth	2.25c.
Philadelphia, delivered	2.47c.
New York	2.49c.
On cars dock Gulf ports	2.50c.
On cars dock Pacific ports	2.75c.

RAIL STEEL BARS

(For merchant trade)

Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham	2.15c.
On cars dock Tex. Gulf ports	2.50c.
On cars dock Pacific ports	2.75c.

BILLET STEEL REINFORCING BARS

(Straight lengths as quoted by distributers)

Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Cleveland, Youngstown or Sparrows, Pt.	2.15c.
Detroit, delivered	2.25c.
On cars dock Tex. Gulf ports	2.50c.
On cars dock Pacific ports	2.60c.

RAIL STEEL REINFORCING BARS

(Straight lengths as quoted by distributers)

Pittsburgh, Chicago, Gary, Buffalo, Cleveland, Youngstown or Birmingham	2.15c.
Detroit, delivered	2.25c.
On cars dock Tex. Gulf ports	2.50c.
On cars dock Pacific ports	2.60c.

IRON BARS

Chicago and Terra Haute	2.15c.
Pittsburgh (refined)	3.60c.

COLD FINISHED BARS AND SHAFTING*

Pittsburgh, Buffalo, Cleveland, Chicago, and Gary	2.65c.
Detroit	2.70c.

* In quantities of 10,000 to 19,999 lb.

PLATES

	Base per Lb.
Pittsburgh, Chicago, Gary, Birmingham, Sparrows Point, Cleveland Youngstown, Coatesville, Claymont, Del.	2.10c. to 2.35c.
Philadelphia, del'd	2.15c. to 2.40c.
New York, del'd.	2.29c. to 2.54c.
On cars dock Gulf ports	2.45c.
On cars dock Pacific ports	2.60c.
Wrought iron plates, P'tg	3.80c.

FLOOR PLATES

Pittsburgh or Chicago	3.35c.
New York, del'd	3.71c.
On cars dock Gulf ports	3.70c.
On cars dock Pacific ports	3.95c.

STRUCTURAL SHAPES

	Base per Lb.
Pittsburgh, Chicago, Gary, Buffalo, Bethlehem or Birmingham	2.10c.
Philadelphia, del'd	2.215c.
New York, del'd	2.27c.
On cars dock Gulf ports	2.45c.
On cars dock Pacific ports	2.70c.

STEEL SHEET PILING

	Base per Lb.
Pittsburgh, Chicago or Buffalo	2.40c.
On cars dock Gulf ports	2.85c.
On cars dock Pacific ports	2.90c.

RAILS AND TRACK SUPPLIES

F.o.b. Mill

Standard rails, heavier than 60 lb., per gross ton	$40.00
Angle bars, per 100 lb.	2.70

F.o.b. Basing Points

Light rails (from billets) per gross ton	$40.00
Light rails (from rail steel) per gross ton	39.00

	Base per Lb.
Cut spikes	3.00c.
Screw spikes	4.55c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast ports	2.25c.
Track bolts, to steam railroads	4.15c.
Track bolts to jobbers, all sizes (per 100 counts)	65-5

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa., Buffalo; on spikes alone, Youngstown, Lebanon, Pa., Richmond, Va.

SHEETS

Hot Rolled

	Base per Lb.
Pittsburgh, Gary, Birmingham, Buffalo, Sparrows Point, Cleveland, Youngstown, Middletown or Chicago	2.00c.
Detroit, delivered	2.10c.
Philadelphia, delivered	2.17c.
Granite City	2.10c.
On cars dock Pacific ports	2.50c.
Wrought iron, Pittsburgh	4.10c.

Cold Rolled*

Pittsburgh, Gary, Buffalo, Youngstown, Cleveland, Middletown or Chicago	3.05c.
Detroit, delivered	3.15c.
Granite City	3.15c.
Philadelphia, delivered	3.37c.
On cars dock Pacific ports	3.65c.

* Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base.

From May 10 up to and including May 15, reductions from the base price of hot and cold rolled sheets running from $4 to $8 a ton were prevalent. Concessions withdrawn on May 15.

Subsequent to May 15, many orders originally placed at $4 to $6 below the base price were adjusted to the full $8 concession.

Galvanized Sheets, 24 Gage

Pittsburgh, Chicago, Gary, Sparrows Point, Buffalo, Middletown, Youngstown or Birmingham	3.50c.
Philadelphia, delv'd	3.67c.
Granite City	3.60c.
On cars dock Pacific ports	4.00c.
Wrought iron, Pittsburgh	6.10c.

Electrical Sheets

(F.o.b. Pittsburgh)

	Base per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon Strip in coils—Sheet price plus silicon sheet extra width extra plus 25c per 100 lb. for coils. Pacific ports add 70c. a 100 lb.

Long Ternes

No. 24 unassorted 8-lb. coating f.o.b. Pittsburgh or Gary	3.80c.
F.o.b. cars dock Pacific ports	4.50c.

Vitreous Enameling Stock, 20 Gage*

Pittsburgh, Chicago, Gary, Youngstown, Middletown or Cleveland	3.35c.
Detroit, delv'd	3.45c.
Granite City	3.45c.
On cars dock Pacific ports	3.95c.

TIN MILL PRODUCTS

*Tin Plate

	Per Base Box
Standard cokes, Pittsburgh, Chicago and Gary	$5.00
Standard cokes, Granite City	5.10

* Prices effective Nov. 10 on shipments through first quarter of 1939.

Special Coated Manufacturing Ternes

	Per Base Box
Granite City	$4.40
Pittsburgh or Gary	4.30

Roofing Terne Plate

(F.o.b. Pittsburgh)

(Per Package, 112 sheets, 20 x 28 in.)	
8-lb. coating I.C.	$12.00
15-lb. coating I.C.	14.00
20-lb. coating I.C.	15.00
25-lb. coating I.C.	16.00
30-lb. coating I.C.	17.25
40-lb. coating I.C.	19.50

Black Plate, 29 gage and lighter

Pittsburgh, Chicago and Gary	3.05c.
Granite City	3.15c.
On cars dock Pacific ports, boxed	4.00c.

HOT ROLLED STRIP

(Widths up to 12 in.)

	Base per Lb.
Pittsburgh, Chicago, Gary, Cleveland, Middletown, Youngstown or Birmingham	2.00c.
Detroit, delivered	2.10c.

Cooperage Stock

Pittsburgh & Chicago	2.10c.

From May 10 up to and including May 15, reductions in the base price of hot rolled strip running from $4 to $8 a ton were prevalent. Concessions withdrawn on May 15.

Subsequent to May 15, many orders originally placed at $4 to $6 below the base price were adjusted to the full $8 concession.

COLD ROLLED STRIP*

	Base per Lb.
Pittsburgh, Youngstown or Cleveland	2.80c.
Chicago	2.90c.
Detroit, delivered	2.90c.
Worcester	3.00c.

* Carbon 0.25 and less.

Commodity Cold Rolled Strip

Pittsburgh, Youngstown, or Cleveland	2.95c.
Detroit, delivered	3.05c.
Worcester	3.35c.

From May 10 up to and including May 15, reductions from the base price of cold rolled strip amounting to $4 a ton were prevalent. Concessions withdrawn on May 15.

COLD ROLLED SPRING STEEL

		Pittsburgh and Cleveland	Worcester
Carbon	0.26-0.50%	2.80c.	3.00c.
Carbon	0.51-0.75	4.30c.	4.50c.
Carbon	0.76-1.00	6.15c.	6.35c.
Carbon	1.01-1.25	8.35c.	8.55c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh, Chicago, Cleveland and Birmingham)

To Manufacturing Trade

	Per Lb.
Bright wire	2.60c.
Galvanized wire, base	2.65c.*
Spring wire	3.20c.

* On galvanizing wire to manufacturing trade, size and galvanizing extras are charged, the price Nos. 6 to 9 gage, inclusive, thus being 3.15c.

To the Trade

	Base per Keg
Standard wire nails	$2.55
Coated nails	2.55
Cut nails, carloads	3.70

	Base per 100 Lb.
Annealed fence wire	$2.90
Galvanized fence wire	3.30
Twisted barbless wire	3.40
Woven wire fence, No. 11 and heavier, base col.	70
Woven wire fence, lighter than No. 11, base col.	67
Single loop bale ties, base col.	56
Stand. 2 pt., 12.5 gage barbed cattle wire, per 80 rod spool	$2.70
Stand. 2 pt., 12.5 gage barbed hog wire, per 80 rod spool	$2.88

Note: Birmingham base same on above items, except spring wire.

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel In.	Black	Galv.	*Wrought Iron* In.	Black	Galv.
⅛	56	36	¼ & ⅜	+9	+30
¼ to ⅜	59	43½	½	24	6½
½	63½	54	¾	30	13
¾	66½	60½	1 & 1¼	34	19
1 to 3	68½	60½	1½	38	21½
			2	37½	21

Lap Weld

2	61	52½	2	30½	15
2½ & 3	64	55½	2½ to 3½	31½	17½
3½ to 6.66		57½	4	33½	21
7 & 8.65		55½	4½ to 8.32	1½	20
9 & 10.64	1½	55	9 to 12.	28½	15
11 & 12.63	1½	54			

Butt weld, extra strong, plain ends

⅛	54½	41½	¼ & ⅜	+10	+43
½ to ⅜	56½	45½	½	25	9
½	61½	37½	¾	31	15
¾	65½	57½	1 to 2	38	22½
1 to 3	67	60			

Lap weld, extra strong, plain ends

2	59	51½	2	33½	18½
2½ & 3	63	55½	2½ to 4	39½	25½
3½ to 6.66	1½	59	4½ to 6	37½	24
7 & 8.65	1½	56	7 & 8	38½	24½
9 & 10.64	1½	55	9 to 12	32	20½
11 & 12.63	1½	54			

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount of $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher, on all butt weld 6 in. and smaller.

Boiler Tubes

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes. Minimum Wall. (Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld Hot Rolled
1 in. o.d. 13 B.W.G.	$ 9.01	$ 7.82	....
1¼ in. o.d. 13 B.W.G.	10.67	9.26	....
1½ in. o.d. 13 B.W.G.	11.70	10.23	$9.72
1¾ in. o.d. 13 B.W.G.	13.42	11.64	11.06
1 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2¼ in. o.d. 13 B.W.G.	16.76	14.54	13.79
2½ in. o.d. 12 B.W.G.	18.45	16.01	15.16
2¾ in. o.d. 12 B.W.G.	20.21	17.54	16.58
2¾ in. o.d. 12 B.W.G.	21.42	18.59	17.54
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66
4½ in. o.d. 10 B.W.G.	43.04	37.35	35.22
5 in. o.d. 9 B.W.G.	54.01	46.87	44.25
6 in. o.d. 7 B.W.G.	82.93	71.96	68.14

Extras for less carload quantities:

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	30%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

CAST IRON WATER PIPE

Per Net Ton

*6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
*6-in. and larger, Birmingham	46.00
6-in. and larger, f.o.b. deck, San Francisco or Los Angeles	52.00
F.o.b. dock, Seattle	52.00
4-in. f.o.b. dock, San Francisco or Los Angeles	55.00
F.o.b. dock, Seattle	52.00

Class "A" and gas pipe, $3 extra 4-in. pipe is $3 a ton above 6-in.

Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $45, Birmingham, and $53.80 delivered Chicago.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland Birmingham or Chicago)

Per Cent Off List

Machine and carriage bolts:	
½ in. and 6 in. and smaller	68½
Larger and longer up to 1 in.	66
1⅛ in. and larger	64
Lag bolts	66
Plow bolts, Nos. 1, 2, 3, and 7	68½
Hot pressed nuts, and c.p.c. and t-nuts, square or hex. blank or tapped:	
½ in. and smaller	67
9/16 in. to 1 in. inclusive	64
1⅛ in. and larger	62

On the above items with the exception of plow bolts, there is an additional allowance of 10 per cent for full container quantities.

On all of the above items there is an additional 5 per cent allowance for carload shipments.

	U.S.S.	S.A.E.
Semi-fin. hexagon nuts ½ in. and smaller	67	70
9/16 to 1 in.	64	65
1⅛ in. and larger	62	62

In full container lots, 10 per cent additional discount.

Stove bolts in packages, with nuts loose	72½
Stove bolts in packages, with nuts attached, add 15% extra.	
Stove bolts in bulk	83½

On stove bolts freight is allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 Lb.

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham $3.40

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland Chicago, Birmingham ... 65 and 10

Cap and Set Screws

(Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.)

Per Cent Off List

Milled hexagon head, cap screws, 1 in. dia. and smaller	50 and 10
Milled headless set screws, cut thread ¼ in. and larger	64
3/16 in. and smaller	73
Upset hex. head cap screws U.S.S. or S.A.E. thread 1 in. and smaller	70
Upset set screws, cup and oval points	75
Milled studs	52

Alloy Steel

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Base price, $56.00 a gross ton.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade, base	2.70c.
Delivered, Detroit	2.80c.

S.A.E. Series Numbers	Alloy Differential per 100 Lb.
200 (½% Nickel)	$0.35
2100 (1½% Nickel)	0.75
2300 (3½% Nickel)	1.55
2500 (5% Nickel)	2.25
3100 Nickel-chromium	0.70
3200 Nickel-chromium	1.85
3300 Nickel-chromium	3.80
3400 Nickel-chromium	3.20
4100 Chromium-molybdenum (0.15 to 0.25 Molybdenum)	0.55
4100 Chromium-molybdenum (0.25 to 0.40 Molybdenum)	0.75
4340 Chr.-Ni.-Mo.	1.65
4345 Chro.-Ni.-Mo.	1.85
4600 Nickel - molybdenum (0.20 to 0.30 Mo. 1.50 to 2.00 Ni.)	1.10
5100 Chrome steel (0.60-0.90 Cr.)	0.35
5100 Chrome steel (0.80-1.10 Cr.)	0.45
6100 Chromium spring steel	0.15
6100 Chromium-vanadium bar	1.20
6100 Chromium-vanadium spring steel	0.85
Chromium-nickel vanadium	1.50
Carbon-vanadium	0.85

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.35c. base per lb. Delivered Detroit, 3.45c., carlots.

STAINLESS & HEAT RESISTANT ALLOYS

(Base prices, cents per lb. f.o.b. Pittsburgh)

Chrome-Nickel

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25c.	24c.
Plates	29c.	27c.
Structural shapes	25c.	24c.
Sheets	36c.	34c.
Hot-rolled strip	23.50c.	21.50c.
Cold-rolled strip	30c.	28c.
Drawn wire	25c.	24c.

Straight Chrome

	No. 410	No. 430	No. 442	No. 446
Bars	18.50c.	19c.	22.50c.	27.50c.
Plates	21.50c.	22c.	25.50c.	30.50c.
Sheets	26.50c.	29c.	32.50c.	36.50c.
Hot stp.	17c.	17.50c.	24c.	35c.
Cold stp.	22c.	22.50c.	32c.	52c.

TOOL STEEL

High speed	67c.
High-carbon-chrome	43c.
Oil-hardening	24c.
Special	22c.
Extra	18c.
Regular	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

British and Continental

BRITISH

Per Gross Ton f.o.b. United Kingdom Ports

Ferromanganese, export	Nominal
Tin plate, per base box	27s. to 29s.
Steel bars, open hearth	Nominal
Beams, open hearth	Nominal
Channels, open hearth	Nominal
Angles, open hearth	Nominal
Black sheets, No. 24 gage	Nominal
Galvanized sheets, No. 24 gage	Nominal

CONTINENTAL

Per Gross Ton, Gold £, f.o.b. Continental Ports

Billets, Thomas	Nominal
Wire rods, No. 5 B.W.G.	£5 10s.
Steel bars, merchant	£5 5s.
Sheet Bars	Nominal
Plate ¼ in. and up	£5 7s.
Plate 3/16 in. and 5 mm.	£5 13s.
Sheet ⅛ in.	£5 9s. 6d.
Beams, Thomas	£4 18s.
Angles (Basic)	£4 18s.
Hoops and strip, base	£5 12s.

RAW MATERIALS PRICES

PIG IRON

No. 2 Foundry

F.o.b. Everett, Mass.	$24.00.
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa., and Sparrows Point, Md.	24.00
Delivered Brooklyn	26.50
Delivered Newark or Jersey City	25.53
Delivered Philadelphia	24.84
F.o.b. Neville Island, Erie, Pa., Toledo, Chicago, Granite City, Cleveland and Youngstown	23.00
F.o.b. Buffalo	23.00
F.o.b. Detroit	23.00
Southern, delivered Cincinnati	23.06
Northern, delivered, Cincinnati	23.44
F.o.b. Duluth	23.50
F.o.b. Provo, Utah	21.00
Delivered, San Francisco, Los Angeles or Seattle	26.50
F.o.b. Birmingham*	19.38

* Delivered prices on southern iron for shipment to northern points are 38c. a ton below delivered prices from nearest northern basing point on iron with phosphorus content of 0.70 per cent and over.

Malleable

Base prices on malleable iron are 50c. a ton above No. 2 foundry quotations at Everett, Eastern Pennsylvania furnaces, Erie and Buffalo. Elsewhere they are the same, except at Birmingham and Provo, which are not malleable iron basing points.

Basic

F.o.b. Everett, Mass.	$23.50
F.o.b. Bethlehem, Birdsboro, Swedeland and Steelton, Pa., and Sparrows Point, Md.	23.50
F.o.b. Buffalo	22.00
F.o.b. Neville Island, Erie, Pa., Toledo, Chicago, Granite City, Cleveland and Youngstown	22.50
Delivered Philadelphia	24.34
Delivered Canton, Ohio	23.89
Delivered Mansfield, Ohio	24.44
F.o.b. Birmingham	18.00

Bessemer

F.o.b. Buffalo	$24.00
F.o.b. Everett, Mass.	25.00
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa.	25.00
Delivered Newark or Jersey City	26.53
Erie, Pa., and Duluth	24.00
F.o.b. Neville Island, Toledo, Chicago and Youngstown	23.50
F.o.b. Birmingham	24.00
Delivered Cincinnati	24.11
Delivered Canton, Ohio	24.89
Delivered Mansfield, Ohio	25.44

Low Phosphorus

Basing points: Birdsboro, Pa., Steelton, Pa., and Buffalo....$28.50

Gray Forge

Valley or Pittsburgh furnace..$22.50

Charcoal

Lake Superior furnace	$27.00
Delivered Chicago	30.34

Canadian Pig Iron

Per Gross Ton

Montreal	
Foundry iron	$27.50 base
Malleable	28.00 base
Basic	27.50 base
Toronto	
Foundry iron	$25.50 base
Malleable	26.00 base
Basic	25.50 base

On all grades 2.25 per cent silicon and under is base. For each 25 points of silicon over 2.25 per cent an extra of 25c. is charged.

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload).....$100.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%	$32.00
Domestic, 26 to 28%	39.50

Electric Ferrosilicon

Per Gross Ton Delivered; Lump Size

50% (carload lots, bulk)	$69.50*
50% (ton lots in 50 gal. bbl.)	80.50*
75% (carload lots, bulk)	126.00*
75% (ton lots in 50 gal. bbl.)	139.00*

Bessemer Ferrosilicon

F.o.b. Furnace, Jackson, Ohio

Per Gross Ton

10.00 to 10.50%.....$32.50

For each additional 0.50% silicon up to 12%, 50c. per ton is added. Above 12% add 75c. per ton.

For each unit of manganese over 2%, $1 per ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Silvery Iron

Per Gross Ton

F.o.b. Jackson, Ohio, 5.00 to 5.50% $26.50

For each additional 0.5% silicon up to 12%, 50c. a ton is added. Above 12% add 75c. a ton. The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Ferrochrome

Per Lb. Contained Cr., Delivered Carlots, Lump Size, on Contract

4 to 6% carbon	10.50c.*
2% carbon	16.50c.*
1% carbon	17.50c.*
0.10% carbon	19.50c.*
0.06% carbon	20.00c.*

Silico-Manganese

Per Gross Ton, Delivered, Lump Size, Bulk, on Contract

3% carbon	$98.00
2.50% carbon	103.00
2% carbon	108.00
1% carbon	118.00

Other Ferroalloys

Ferrotungsten, per lb. contained W del., carloads	$2.00
Ferrotungsten, 100 lbs. and less	2.25
Ferrovanadium, contract, per lb. contained V., delivered	$2.70 to $2.90†
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y., ton lots	$2.25†
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace carload and contract per net ton	$142.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton	$157.50
Ferrophosphorus, electric, or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, electrolytic, 23-26% in car lots, f.o.b. Monsanto (Siglo), Tenn., 24%, per gross ton, $3 unitage, freight equalized with Nashville	$75.00
Ferromolybdenum, per lb. Mo. f.o.b. furnace	95c.
Calcium molybdate, per lb. Mo. f.o.b. furnace	80c.
Molybdenum oxide briquettes 48-52% Mo: per lb. contained Mo, f.o.b. Langeloth, Pa.	80c.

* Spot prices are $5 per ton higher.
† Spot prices are 10c. per lb. of contained element higher.

*ORES

Lake Superior Ores

Delivered Lower Lake Ports

Per Gross Ton

Old range, Bessemer, 51.50%...	$5.25
Old range, non-Bessemer, 51.50%	5.10
Messabi, Bessemer, 51.50%	5.10
Messabi, non-Bessemer, 51.50%	4.95
High phosphorus, 51.50%	4.85

Foreign Ore*

C.i.f. Philadelphia or Baltimore

Per Unit

Iron, low phos., copper free, 55 to 58% dry, Algeria	12c.
Iron, low phos., Swedish, average, 68½% iron	12c.
Iron, basic or foundry, Swedish, aver. 65% iron	11c.
Iron, basic or foundry, Russian, aver. 65% iron	Nominal
Man., Caucasian, washed 52%	44c.
Man., African, Indian, 44-48%	41c.
Man., African, Indian, 49-51%	45c.
Man., Brazilian, 46 to 48%	40c.

Per Short Ton Unit

Tungsten, Chinese, Wolframite, duty paid, delivered	$23.00 to $24.00
Tungsten, domestic, scheelite delivered	25.00
Chrome or (lump) c.i.f. Atlantic Seaboard, per gross ton: South African (low grade)	$17.00
Rhodesian, 45%	21.00
Rhodesian, 48%	25.00
Turkish, 48-49%	25.50
Turkish, 45-46%	23.00
Turkish, 40-41%	18.50
Chrome concentrates (Turkish) c.i.f. Atlantic Seaboard, per gross ton: 50%	$26.00
48-49%	25.00

* All foreign ore prices are nominal.

FLUORSPAR

Per Net Ton

Domestic washed gravel, 85-5, f.o.b. Kentucky and Illinois mines, all rail	$22.00
Domestic, f.o.b. Ohio River landing barges	$22.00
No. 2 lump, 85-5, f.o.b. Kentucky and Ill. mines	$20.00 to $22.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	$22.50 to $23.50
Domestic No. 1 ground bulk, 96 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	$31.60

FUEL OIL

Per Gal.

No. 2, f.o.b. Bayonne, N. J.	4.375c.
No. 6, f.o.b. Bayonne, N.J.	2.74c.
No. 5 Bur. Stds., del'd Chicago	3.25c.
No. 6 Bur. Stds., del'd Chicago	2.75c.
No. 3 distillate, del'd Cleve'd.	5.375c.
No. 4 industrial, del'd Cleve'd.	5.125c.
No. 5 industrial, del'd Cleve'd.	4.25c.
No. 6 industrial, del'd Cleve'd.	4.00c.

COKE

Per Net Ton

Furnace, f.o.b. Connellsville, Prompt	$5.00 to $5.50
Foundry, f.o.b. Connellsville, Prompt	5.75 to 6.25
Foundry, by - product Chicago ovens	10.25
Foundry, by - product del'd New England	12.50
Foundry, by - product del'd Newark or Jersey City	10.88 to 11.40
Foundry, by - product Philadelphia	10.95
Foundry, by - product delivered Cleveland	10.30
Foundry, by - product delivered Cincinnati	9.75
Foundry, Birmingham	7.50
Foundry, by - product del'd St. Lois industrial district	10.75 to 11.00
Foundry, from Birmingham, f.o.b. cars dock Pacific ports	14.75

IRON AND STEEL WAREHOUSE PRICES

PITTSBURGH*

	Base per Lb.
Plates	3.40c.
Shapes	3.40c.
Soft steel bars and small shapes	3.35c.
Reinforcing steel bars	2.70c.
Cold finished bars and screw stock	3.65c.
Hot rolled strip	3.60c.
Hot rolled sheets	3.35c.
Galv. sheets (24 ga.) 500 lb. to 1499 lb.	4.75c.
Wire, black, soft annealed	3.15c.
Wire, galv., soft	3.55c.
Track spikes (1 to 24 kegs)	3.60c.
Wire nails (in 100-lb. kegs)	2.65c.

On plates, structurals, bars, strip and hot rolled sheets, base applied to orders of 400 to 1999 lb. On reinforcing bars base applies to orders of less than one ton and includes switching and carting charge.

All above prices for delivery within the Pittsburgh switching district

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.76c.
Structural shapes	3.75c.
Soft steel bars, round	3.84c.
Iron bars, Swed. charcoal	9.50c.
Cold-fin. shafting and screw stock:	
Rounds, squares, hexagons	4.09c.
Flats up to 12 in. wide	4.09c.
Cold-rolled strip soft and quarter hard	3.51c.
Hot-rolled strip, soft O.H.	3.96c.
*Hot-rolled sheets (8-30 ga.)	3.58c.
**Galv. sheets (24 ga.)	4.74c.
Long ternes (24 ga.)	5.50c.
Cold-rolled sheets (20 ga.)	
Standard quality	4.60c.
Deep drawing	4.85c.
Stretcher leveled	5.10c.
SAE, 2300, hot-rolled	7.35c.
SAE, 3100, hot-rolled	5.90c.
SAE, 6100, hot-rolled annealed	8.75c.
SAE, 2300, cold-rolled	8.59c.
SAE, 3100, cold-rolled, annealed	8.19c.
Floor plate, ⅛ in. and heavier	5.56c.
Standard tool steel	12.50c.
Wire, black, annealed (No. 9)	4.35c.
Wire, galv. (No. 9)	4.70c.
Open-hearth spring steel	5.20c. to 10.20c.
Common wire nails, per keg in lots of one to nine kegs	3.10c.

* For lots less than 2000 lb.
**For lots of 1500 lb. or more.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.55c.
Soft steel bars, rounds and angles	3.50c.
Soft steel squares, hexagons, channels and Tees	3.65c.
Hot rolled strip	3.60c.
Floor plates	5.15c.
Hot rolled sheets	3.35c.
Galvanized sheets	4.60c.
Cold rolled sheets	4.30c.
Cold finished carbon bars	3.75c.

Above prices are subject to deductions and extras for quantity and are f.o.b. consumer's plant within Chicago free delivery zone.

CLEVELAND

	Base per Lb.
Plates	3.40c.
Structural shapes	3.58c.
Soft steel bars	**3.25c.**
Reinfor. bars (under 2000 lb.)†	2.55c.
Cold-fin. bars (1500 lb., over.)	3.75c.
Hot-rolled strip	3.50c.
Cold rolled sheets	4.55c.
Cold-finished strip	3.20c.
Galvanized sheets (No. 24)	4.62c.
Hot-rolled sheets	3.35c.
Floor plates, 3/16 in. and heavier	5.18c.
*Black ann'l'd wire, per 100 lb.	$3.10
*No. 9 galv. wire, per 100 lb.	3.50
*Com. wire nails, base per keg	2.60
Hot rolled alloy steel (3100)	5.85c.
Cold rolled alloy steel (3115)	6.75c.

* For 5000 lb. or less.
† 500 lb. base quantity.
Prices shown on hot rolled bars, strip, sheets, shapes and plates are for 400 to 1999 lbs. Alloy steel, 1000 lb. and over; galvanized sheets, 150 to 1499 lb.; cold rolled sheets, 400 to 1499 lb.

ST. LOUIS

	Base per Lb.
Plates and structural shapes	3.47c.
Bars, soft steel (rounds and flats)	3.62c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	3.77c.
Cold fin. rounds, shafting, screw stock	4.02c.
Galv. sheets (24 ga.)	4.52c.
Hot rolled sheets	3.38c.
Galv. corrugated sheets, 24 ga. and heavier*	4.57c.
Structural rivets	5.02c.

* No. 26 and lighter take special prices.

BOSTON

	Base per Lb.
Structural shapes, 3 in. and larger	3.85c.
Plates, ¼ in. and heavier	3.85c.
Bars	3.88c.
Heavy hot rolled sheets	3.71c.
Hot rolled sheets	4.21c.
Hot rolled annealed sheets	4.61c.
Galvanized sheets	4.61c.
Cold rolled sheets	4.71c.

The following quantity differentials apply: Less than 100 lb., plus $1.50 per 100 lb.; 100 to 399 lb. plus 50c.; 400 to 1999 lb. base; 2000 to 9999 lb. minus 20c.; 10,000 to 39,999 lb. minus 30c.; 40,000 lb. and over minus 40c.

BUFFALO

	Base per Lb.
Plates	3.62c.
Floor plates	5.25c.
Struc. shapes	3.40c.
Soft steel bars	3.35c.
Reinforcing bars (20,000 lb. or more)	2.15c.
Cold-fin. flats, squares, rounds, and hex.	3.65c.
Hot-rolled sheets, 3/16 x 14 in. to 48 in. wide incl., also sizes No. 8 to 30 ga.	3.35c.
Galv. sheets (24 ga.)	4.70c.
Bands and hoops	3.82c.

NEW ORLEANS

	Base per Lb.
Mild steel bars	4.20c.
Reinforcing bars	3.24c.
Structural shapes	4.10c.
Plates	4.10c.
Hot-rolled sheets, No. 10	4.35c.
Steel bands	4.75c.
Cold-finished steel bars	5.10c.
Structural rivets	4.85c.
Boiler rivets	4.85c.
Common wire nails, base per keg	3.55
Bolts and nuts, per cent off list	60

REFRACTORIES PRICES

Fire Clay Brick

	Per 1000 f.o.b. Works
Super-duty brick, at St. Louis	$60.80
First quality Pennsylvania, Maryland, Kentucky, Missouri and Illinois	47.50
First quality, New Jersey	52.50
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	42.75
Second quality, New Jersey	49.00
No. 1 Ohio	39.90
Ground fire clay, per ton	7.10

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$47.50
Chicago District	55.10
Birmingham	47.50
Silica cement per net ton (Eastern)	8.55

Chrome Brick

	Net per Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester	$47.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	47.00

Magnesite Brick

	Net per Ton
Standard f.o.b. Baltimore and Chester	$67.00
Chemically bonded, f.o.b. Baltimore	57.00

Grain Magnesite

	Net per Ton
Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	$45.00
Domestic, f.o.b. Baltimore and Chester in sacks	40.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	3.55c.
*Structural shapes	3.55c.
*Soft steel bars, small shapes, iron bars (except bands)	3.85c.
‡Reinforc. steel bars, square and deformed	2.76c.
Cold-finished steel bars	4.16c.
*Steel hoops	4.35c.
*Steel bands, No. 12 and 3/16 in. incl.	3.85c.
*Spring steel	5.00c.
†Hot-rolled anneal. sheets	3.55c.
†Galvanized sheets (No. 24)	4.68c.
*Diam. pat. floor plates, ¼ in.	5.25c.

*For quantities between 400 and 1999 lb.
†For 10 bundles or over.
‡For one to five tons.

BIRMINGHAM

	Base per Lb.
Bars and bar shapes	3.50c.
Structural shapes and plates	3.55c.
Hot rolled sheets No. 10 ga.	3.35c.
Galvanized sheets No. 24 ga. or more	4.75c.
Strip	3.60c.
Reinforcing bars	3.50c.
Floor plates	5.88
Cold finished bars	4.43
Machine and carriage bolts	50 & 10 off list
Rivets (structural)	$4.60 base

On plates, shapes, bars, hot-rolled strip, heavy hot-rolled sheets, the base applies on 400 to 1999 lb. All prices are f.o.b. consumer plant.

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tanks and U. M.	4.00c.	3.80c.	3.85c.
Shapes, standard	4.00c.	3.80c.	3.95c.
Soft steel bars	4.00c.	3.80c.	3.90c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.275c.	open.	2.975c
Hot-rolled sheets (No. 10)	3.75c.	4.00c.	3.70c.
Galv. sheets (No. 24 and lighter)	5.15c.	5.00c.	5.00c.
Galv. sheets (No. 22 and heavier)	5.40c.	5.00c.	5.00c.
Cold-finished steel Rounds	6.55c.	6.60c.	7.10c
Squares and hexagons	7.80c.	7.85c.	7.10c
Flats	8.30c.	8.35c.	8.10c
Common wire nails—base per keg less carload	$3.00	$3.05	$3.00

All items subject to differentials for quantity.

ST. PAUL

	Base per Lb
Mild steel bars, rounds	4.10c
Structural shapes	4.00c
Plates	4.00c
Cold-finished bars	4.83c
Hot-rolled annealed sheets, No. 24	4.75c
Galvanized sheets, No. 24	5.00c

On mild steel bars, shapes and plates the base applies on 400 to 14,999 lb. On hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over Base on cold-finished bars is 1000 lb. and over of a size.

DETROIT

	Base per Lb
Soft steel bars	3.33c
Structural shapes	3.65c
Plates	3.60c
Floor plates	5.27c
Hot-rolled sheets, 8 to 30 gages above 12 in. and 3/16 in., 24 in. to 48 in. wide	3.43c
Cold-rolled sheets	4.50c
*Galvanized sheets	4.59c
Hot-rolled strip, under No. 12	3.68c
Hot-rolled strip, No. 12 and over	3.43c
Cold-finished bars	3.80c.
Cold-rolled strip	3.55c.
Hot-rolled alloy steel (SAE 3100 Series)	5.97c.
Cold-rolled alloy (SAE 2300)	8.45c.

Quantity extras apply to all items.
*Price applies only in metropolitan Detroit.

PLANT EXPANSION AND EQUIPMENT BUYING

NORTH ATLANTIC

Laminated Shim Co., 21-44 Forty-fourth Avenue, Long Island City, New York, brass and other metal shims, babbitt-tipped shims, etc., has acquired about 2½ acre tract at Glenbrook, Conn., for new plant. Plans are being drawn for initial one-story unit, about 25,000 sq. ft. of floor space, for which bids will be asked soon on general contract. Cost over $65,000 with equipment. Present works will be removed to new location and capacity increased.

Continental Oil Co., 60 East Forty-second Street, New York, plans expansion and improvements in oil refinery at Ponca City, Okla., comprising new production units for gasoline and refined oils, remodeling and extensions in pumping machinery and accessories, steam system, electrical system and other divisions; also new thermal gasoline cracking plant. Award for part of work has been made to M. W. Kellogg Co., 225 Broadway, New York, and other contracts will be placed soon. Cost close to $1,500,000.

Commanding Officer, Ordnance Department, Watervliet Arsenal, Watervliet, N. Y., asks bids until Oct. 24 for steel castings (Circular 162); until Oct. 27, gas check pad containers (Circular 143, one bed-type plain milling machine, two vertical milling machines, two horizontal milling machines (Circular 146).

West Virginia Pulp & Paper Co., 230 Park Avenue, New York, has approved plans for addition to mill at North Charleston, S. C., to be equipped as an evaporator unit. Cost about $100,000 with equipment.

Queensboro Bridge Railway Co., 51-28 Northern Boulevard, Woodside, L. I., has let general contract to Wininger & Selby, Inc., 152 West Forty-second Street, New York, for one-story motorbus service, repair and garage buildings at 19-80 and 19-70 Steinway Avenue, Astoria, L. I. Cost over $60,000 with equipment. Charles M. Hart is company architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 24 for 100 metal litters (Schedule 7455) for Brooklyn Navy Yard; engine gage units, electric thermometer indicators and spare parts (Schedule 7394) for Philadelphia yard; until Oct. 31, eight stockless anchors (Schedule 7494) for Staten Island, New York.

Aviation Mfg. Corp., 420 Lexington Avenue, New York, military and commercial airplanes, aircraft engines, propellers, etc., will award contract soon for new plant at Nashville, Tenn., recently announced, where 36-acre tract has been purchased adjoining municipal airport. It will comprise several one-story units for parts production and assembling, totaling about 125,000 sq. ft. of floor space. Cost close to $250,000 with equipment.

Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until Oct. 27 for connectors and plugs (Circular 94); until Oct. 30 for power units (Circular 100); until Nov. 3, 1000 mast bases, 10,850 mast sections, washers, etc. (Circular 112).

Merck & Co., Inc., Rahway, N. J., chemicals, drugs, etc., has let general contract to Walter Kidde Constructors, Inc., 140 Cedar Street, New York, for three one-story additions, comprising a double structure for main manufacturing division, 100 x 175 ft., and smaller unit, 50 x 160 ft., for storage and distribution. Cost close to $300,000 with equipment. Ballinger Co., 105 South Twelfth Street, Philadelphia, is architect and engineer.

Commanding Officer, Ordnance Department, Picatinny Arsenal, near Dover, N. J., asks bids until Oct. 23 for 25 high-speed steel thread cutters (Circular 483), 1500 steel wire screens (Circular 484); until Oct. 24, 500 steel tote boxes, 18 in. long, 10 in. wide and 6 in. deep (Circular 490), one tool post grinder (Circular 496).

Richmond Machine Co., 3375 Richmond Street, Philadelphia, machinery and parts, has let general contract to Walter Rybas, 8832 Frankford Avenue, for two-story machine shop addition. Cost close to $40,000 with equipment. A. R. Nickol, 7528 Bingham Street, is architect.

Textile Machine Works, Inc., Reading, Pa., machinery and parts, plans two-story addition to plant on Hill Street, Wyomissing district. Cost close to $60,000 wtih equipment.

Commanding Officer, Ordnance Department, Frankford Arsenal, Bridesburg, Philadelphia, asks bids until Nov. 3 for 32 transmission systems, eight sets of carriage equipment, spare parts and generating units (Circular 77).

BUFFALO DISTRICT

Scintilla Magneto Corp., Sidney, N. Y., magnetos and parts, etc., has let general contract to Frank Lewis & Son, Bainbridge, N. Y., for one-story and basement addition, 50 x 200 ft. Cost over $85,000 with equipment.

Eastern State Milling Corp., Ontario Street and Military Road, Buffalo, is considering new grain milling plant and elevator at Huron, Ohio, with conveying, screening, elevating and other mechanical equipment. Cost reported over $175,000 with equipment.

Hooker Electro Chemical Co., Buffalo Avenue and Forty-seventh Street, Niagara Falls, N. Y., heavy industrial chemicals, has let general contract to C. C. Bremer & Co., 2576 Seneca Avenue, for one-story addition. Cost about $50,000 with equipment. Main offices are at 60 East Forty-second Street, New York.

WASHINGTON DIST.

Engineer-in-Chief, United States Coast Guard Headquarters, Washington, asks bids until Oct. 26 for marine gasoline engines and auxiliary equipment (Circulars 3544 and 3545).

Rustless Iron & Steel Corp., 3400 East Chase Street, Baltimore, has approved plans for two large one-story additions, to be equipped for a rolling mill and as a grinding division, respectively, in connection with other new plant units now in progress on Edison Highway. Cummins Construction Corp., 803 Cathedral Street, is general contractor. Entire project will cost about $1,000,000 with equipment.

General Purchasing Officer, Panama Canal, Washington, asks bids until Oct. 23 for one chain hoist, copper cable, knife switches, etc. (Schedule 3663); until Oct. 24, two lots of concrete mixers, each lot from two to eight units, and four buckets for concrete (Schedule 3656), 150,000 ft. of steel conduit, 2000 conduit couplings, copper connectors, splicing sleeves, sleeve twisters, clamps, 100,000 ft. of copper wire, 365,000 ft. of rubber-insulated copper wire, 300,000 ft. of telephone wire, 11,600 lb. of steel wire, 35,000 ft. of weatherproof wire, insulator pins, etc. (Schedule 3658).

Bureau of Yards and Docks, Navy Department, Washington, asks bids until Nov. 1 for one steel caisson gate, including pumping machinery, piping, electrical equipment, etc. (Specifications 9449).

Swift & Co., Union Stock Yards, Chicago, have let general contract to H. C. Hamilton, Krise Building, Lynchburg, Va., for one-story factory branch, storage and distributing plant at Lynchburg. Cost close to $45,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 24 for motor-driven pit-type planers (Schedule 7448), motor-driven heavy-duty planers and special tool heads (Schedule 7447), electric cable (Schedules 7445 and 7446), motor-generator set (Schedule 7373) for Eastern and Western navy yards; 20 electric arc welding sets (Schedule 7439); until Oct. 27, one steel propeller shaft (Schedule 7442) for Norfolk yard, Portsmouth, Va.; 16 steel saddles and pattern equipment (Schedule 7438) for Washington yard; 16 to 20 steel mooring buoys (Schedule 7427), 12 electric pumping units (Schedule 7424) for Eastern and Western yards.

NEW ENGLAND

Heald Machine Co., New Bond Street, Worcester, Mass., grinding and other machines, and parts, has let general contract to E. J. Cross Co., 82 Foster Street, for one-story addition. Cost over $50,000 with equipment. Albert Kahn, Inc., New Center Building, Detroit, is architect and engineer.

Commanding Officer, Ordnance Department, Springfield Armory, Springfield, Mass., asks bids until Oct. 23 for 15 high-speed, motor-driven profilers (Circular 115), two broach holders and two sets of broach inserts (Circular 104); until Oct. 24, four contour cutter grinders (Circular 125); until Oct. 30, four machines in accordance with Specifications SED-244, and additional equipment (Circular 109).

United Aircraft Corp., East Hartford, Conn., has approved plans for one-story addition, about 274,000 sq. ft. of floor space, to local Pratt & Whitney Division, aircraft engines and parts, including improvements in present works. Cost close to $1,000,000 with equipment. Company has let general contract to Edwin Moss & Son, 555 Grant Street, Bridgeport, Conn., for one-story foundry, 60 x 160 ft., to plant of Vought-Sikorsky Division, Stratford, Conn. Cost over $80,000 with equipment.

Commanding Officer, Ordnance Department, Watertown Arsenal, Watertown, Mass., asks bids until Nov. 20 for gun railway mounts (Circular 164).

Leland Gifford Co., Worcester, Mass., has started work on a one-story addition, 140 x 200 ft. A. J. Daniels, 664 Main Street, Shrewsbury, Mass., is general contractor.

Hartford Steel Ball Co., West Hartford, Conn., has taken under advisement bids on a 40 x 75 and 30 x 50 ft. plant addition. Greenwood & Noerr, 525 Main Street, Hartford, are engineers.

SOUTH ATLANTIC

John Deere Plow Works, Inc., Moline, Ill., agricultural equipment and implements, plans one-story factory branch, storage and distributing plant on North Tryon Street, Charlotte, N. C. Cost close to $45,000 with equipment. District offices of company are at Atlanta, Ga.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until Oct. 25 for air ejecter, pumping machinery, inter and after-condensers, hot well, piping, etc., for power house at Marine Barracks, Parris Island, S. C. (Specifications 9463).

Chero Coca-Cola Nehi Co., Spartanburg, S. C., plans one-story mechanical-bottling, storage and distributing plant, about 15,000 sq. ft. of floor space, on Asheville Highway, near city limits. Cost about $70,000 with equipment. Robert Freeman, Spartanburg, is architect.

SOUTH CENTRAL

Arkansas Fuel Oil Co., Shreveport, La., has approved plans for new natural gasoline plant in Bistineau oil area, Bienville Parish, La., with compressor station, pumping plant, boiler house, steel tank storage facilities and other structures. Cost over $150,000 with equipment.

United States Engineer Office, Vicksburg, Miss., asks bids until Oct. 23 for 60,000 ft. of plow steel wire rope (Circular 82).

Evangeline Packing Co., Lafayette, La., meat packer, has asked bids on general contract for one-story plant. Cost over $60,000 with equipment.

City Council, Owensboro, Ky., will take bids soon for remodeling municipal electric power plant, including installation of coal

and ash-handling machinery and other equipment. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until Nov. 1 for rubber-insulated wire and cable for Hiwassee dam hydroelectric power station.

SOUTHWEST

Century Electric Co., 1806 Pine Street, St. Louis, motors, generators, fans, parts and other electrical equipment, has asked bids on general contract for one-story storage and distributing building, 90 x 210 ft., on Market Street. Cost over $75,000 with equipment. Klipstein & Rathmann, 316 North Eighth Street, is architect; John D. Falvey, last noted address, is mechanical engineer.

Shell Oil Co., Inc., Shell Building, St. Louis, has let contract to C. F. Braun & Co., Esperson Building, Houston, Tex., for expansion and improvements in crude oil refinery in Deer Park district, Houston, comprising several new units for production of high-test gasoline. Cost close to $1,000,000 with machinery. Company also has awarded contract to Gasoline Plant Construction Corp., Second National Bank Building, Houston, for new natural gasoline extraction plant in Magnolia gas field district, Columbia County, Ark., including compressor station, power house, steel tank storage structures and other divisions. It will be owned jointly with Atlantic Refining Co., Philadelphia, and other oil interests. Cost close to $700,000 with equipment.

United States Engineer Office, 10 East Seventeenth Street, Kansas City, Mo., asks bids until Oct. 23 for two diesel marine engines (Circular 56).

Dart Truck Co., 2648 Oak Street, Kansas City, Mo., motor trucks, trailers and parts, will take bids soon on general contract for one and two-story addition, 100 x 132 ft. Cost about $80,000 with equipment. Robert R. Raney, Union Station Building, is architect.

Reed Roller Bit Co., Mack Street, Houston, Tex., oil well drilling machinery and kindred equipment, has let general contract to Sam D. Cook, 6418 Esperson Street, for one-story addition, 44 x 175 ft., to testing and experimental plant near Navigation Boulevard. Cost over $50,000 with equipment. Same contractor has work under way on one-story plant addition, 90 x 250 ft., to cost about $65,000 with equipment, for which award was made recently.

Commanding Officer, Ordnance Department, San Antonio Arsenal, San Antonio, Tex., asks bids until Oct. 27 for 12 gasoline blow torches, two welding and cutting outfits, metal shields, etc. (Circular 13).

OHIO AND INDIANA

Aeronautical Corp. of America, Inc., Lunken Airport, Cincinnati, monoplanes and other types of aircraft, parts, etc., will take bids soon on general contract for new one-story plant at Middletown Airport, Middletown, Ohio, totaling 50,000 sq. ft. of floor space, for parts production and assembling; a one-story adjoining building will be used for office and operating service. Cost close to $100,000 with equipment. Garriott & Becker, Times-Star Building, are architects; O. W. Motz, 920 East McMillan Street, is engineer, both Cincinnati.

Cleveland Pneumatic Tool Co., 3734 East Seventy-eighth Street, Cleveland, has let general contract to Sam W. Emerson Co., 1836 Euclid Avenue, for one-story L-shaped addition, 62 x 82 x 120 ft., to be known as plant No. 7, and for additions and improvements in plants Nos. 2 and 6. Cost close to $100,000 with equipment. Ernest McGeorge, East Ninety-third and Quincy Streets, is consulting engineer.

Kroger Grocery & Baking Co., 35 East Seventh Street, Cincinnati, has let general contract to Morton C. Tuttle Co., 1034 Depot Street, for new five-story and basement plant unit on State Street, 197 x 242 ft. Part of structure will be used by Kroger Food Foundation, an associated interest, for experimental laboratories. Cost about $500,000 with traveling ovens, conveyors, mixers, loaders and other mechanical equipment. Tietig & Lee, 34 West Sixth Street, are architects; A. M. Kinney, Inc., Carew Tower Building, is mechanical engineer.

Contracting Officer, Materiel Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until Oct. 23 for 800 machinists' bench vises and six blacksmith's vises (Circular 367), one motor-generator set and control panel (Circular 379), 204 cast iron bench blocks and 40 cast iron surface plates (Circular 381), 12 machinery testing levels (Circular 382); until Oct. 24, engine nuts, aircraft nuts, conduit nuts, etc. (Circular 359), 16 electric portable sanders (Circular 384), one bolt machine and one set of bolt chasers (Circular 383); until Oct. 25, 200 extension assemblies (Circular 387); until Oct. 27, miscellaneous airplane parts (Circular 355).

Delco-Remy Division, General Motors Corp., Anderson, Ind., automotive starting and lighting equipment, plans one-story addition, 50 x 150 ft., for testing and experimental service. Cost over $50,000 with equipment.

WESTERN PA. DIST.

United Refining Co., Warren, Pa., has approved plans for expansion and improvements in local oil refinery, consisting of new units and equipment for gasoline and refined oil production. Cost about $200,000 with equipment. Company has purchased oil refinery of Sloan & Zook Co., Bradford, Pa., idle for some time, and will recondition for branch refinery to be operated as Seneca plant.

Louis Marx & Co., Eighteenth and Raspberry Streets, Erie, Pa., mechanical toys, have let general contract to Gillmore, Carmichael & Olson Co., 1873 Fifty-fifth Street, Cleveland, for one-story addition. Cost close to $100,000 with equipment. Main offices of company are at 200 Fifth Avenue, New York.

United States Engineer Office, New Post Office Building, Pittsburgh, asks bids until Nov. 6 for two conduit liners, four deflector plates and four sections of sluice outlet armor plate (Circular 271).

MICHIGAN DISTRICT

Electric Auto-Lite Co., Champlain and Mulberry Streets, Toledo, Ohio, automotive starting and lighting equipment, etc., has asked bids on general contract for one-story addition to branch plant at Port Huron, Mich., including improvements in present works. Cost over $50,000 with equipment.

Roman Cleanser Co., 2700 East McNichols Road, Detroit, cleansers, washing powders, etc., has approved plans for one-story addition. Cost close to $45,000 with equipment. Giffels & Vallet, Inc., and L. Rossetti, Marquette Building, are architects and engineers.

General Trailer Co., Marlette, Mich., recently organized by Gordon Wolfe, Snover, Mich., and associates to manufacture motor trailer and parts, is erecting one-story building, primarily for assembly. Cost close to $40,000 with equipment.

Lufkin Rule Co., Saginaw, Mich., steel rules, steel tapes, etc., has let general contract to Arthur Vollmer, Saginaw, for one-story addition. Cost close to $40,000 with equipment.

MIDDLE WEST

Lincoln Bottling Co., 4343 North Central Park Avenue, Chicago, has let general contract to J. Prusener, 4718 North Avers Avenue, for one and one-half story addition, 55 x 120 ft., for storage and distribution. Cost close to $45,000 with equipment. Edward H. Nordlie, 4825 North California Avenue, is architect.

Link-Belt Speeder Corp., 1201 Sixth Street, S.W., Cedar Rapids, Iowa, conveying and allied equipment, subsidiary of Link-Belt Co., Chicago, has let general contract to Stark Construction Co., 118 Eleventh Street, S.W., for one-story addition. Cost about $45,000 with equipment.

Common Council, Estherville, Iowa, asks bids until Oct. 30 for extensions and improvements in municipal power plant, including new 1500 to 2000-hp. diesel engine-generator unit, exciter, exhaust and intake silencers, starting air tank and compressor, and auxiliary equipment. George W. Shadle, city clerk, is in charge.

National Sheet Steel Co., 13000 Lyndon Avenue, Detroit, has leased one-story building, 35,000 sq. ft. of floor space, at 3153 South California Avenue, Chicago, for new factory branch, storage and distributing plant.

Gillette Rubber Co., Wisconsin Street, Eau Claire, Wis., manufacturer of automobile tires and tubes, has let general contract to Hoeppner-Bartlett Co., 631 East Madison Street, for two-story addition, 50 x 165 ft., for storage and distribution. Cost over $60,000 with equipment.

City Council, Brooklyn, Iowa, has authorized plans for new municipal power plant, for which a bond issue of $135,000 was approved recently. Bids will be asked soon. F. J. Gates, mayor, is in charge.

Metal Box & Cabinet Co., 4716 West Lake Street, Chicago, is considering new two-story and basement plant at 4725 West Kinzie Street. Cost close to $45,000 with equipment.

PACIFIC COAST

Northrop Aircraft, Inc., 126th and Acacia Streets, Hawthorne, Cal., airplanes and parts, has let general contract to E. S. McKittrick Co., 5905 Pacific Boulevard, for new one-story plant near 120th Street and Crenshaw Boulevard, totaling 100,000 sq. ft. of floor space, for parts production and assembling. Cost about $175,000 with equipment. B. G. Reed is company engineer, first noted address.

Metropolitan Water District of Southern California, 306 West Third Street, Los Angeles, asks bids until Oct. 27 for water-softening and filtration plant near La Verne, Cal., for distribution system of Colorado River aqueduct. It will comprise head house, mixing, settling and carbonation units, filters, zeolite softeners, conduits, etc., with jib cranes, electric hoists and other mechanical equipment. Cost reported in excess of $1,500,000.

Vancouver Iron & Steel Foundry Co., Vancouver, Wash., has let contract to Holland Iron Works, Vancouver, for one-story foundry at 1202 West Thirteenth Street. Cost close to $50,000 with equipment. Day Hilborn, Vancouver, is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 24 for one electric furnace (Schedule 7392) for Keyport, Wash.; 77 electric transformers (Schedule 7413) for Mare Island Navy Yard; one motor-driven universal tool and cutter grinder (Schedule 7362), one motor-driven universal grinder (Schedule 7364), two engine lathes (Schedule 7371); until Oct. 27, two combination, motor-driven, contour-metal sawing, filing and polishing machines, floor type (Schedule 7431) for Alameda, Cal., naval station; four steering gears, with spare parts, tools, wrenches, etc. (Schedule 7420) for Puget Sound yard; 12 aircraft aluminum alloy propeller blades (Schedule 900-2826) for San Diego naval air station.

Union Oil Co., Union Oil Building, Los Angeles, has let general contract to Bechtel-McCone-Parsons Corp., 601 West Fifth Street, for group of one-story buildings, about 25,000 sq. ft. of floor space, at refinery at Oleum, Contra Costa County, Cal., including machine shop, boiler shop, change house and other units. Cost over $85,000 with equipment.

Quartermaster Supply Officer, Fort Mason, San Francisco, asks bids until Oct. 23 for seamless steel tubes and condenser tubing (Circular 928-135).

FOREIGN

De Havilland Aircraft Co., Pty., Ltd., Alexandria, New South Wales, Australia, plans one-story addition at Doody and O'Riordan Streets for manufacture of propellers for flying boats and bombing planes. Cost over $300,000 with equipment.

Hayes Steel Products, Ltd., Merritton, Ont., has let general contract to Newman Brothers, 127 St. Paul Street, Ste. Catherine, Ont., for one-story and basement addition, 50 x 200 ft. Cost close to $85,000 with equipment.

Dominion Foundries & Steel, Ltd., Hamilton, Ont., has asked bids on general contract for two one-story additions, 50 x 480 ft., and smaller size for pickling unit. Cost over $400,000 with equipment. Hutton & Souter, 36 James Street, South, are architects.

THIS WEEK'S MACHINE . . . TOOL ACTIVITIES . . .

. . . Machine tool plants gradually approaching limit of available skilled labor . . . Delivery promises still advancing, with no letup in order rate . . . Buying particularly heavy in the East, where military business predominates . . . Price advances up to 20 per cent on deferred shipments.

Domestic Demand Now Overbalances Export Sales

CINCINNATI — Machine tool demand in the Cincinnati area is without letup. Manufacturers of all types of tools indicate that bookings continue to pour in, but note that current demand lacks the proportions reached during the first World War. Domestic demand has now broadened to such an extent that it clearly overbalances export business. Despite this, however, Russia, France and England, particularly the latter two countries, are still very active in current demand. While the bulk of current business was for single units with the general run of multiple units not exceeding 10 to 15, one interest reported a 200 unit order. Deliveries become more and more extended, with the shortest period running from 14 to 18 weeks and the bulk of deliveries running very close to six months. One interest indicates that they are now booked for the next eight months, with the earliest promise on current bookings going from 24 to 30 weeks.

While there is still some margin of available skilled labor, plants indicate that production is gradually approaching the limit of available labor. Night shifts are becoming more general as factories seek to clear assembly lines.

U. S. Auto Firms Expected To Up Canadian Output

DETROIT — Closely allied with Detroit activities are the operations of automotive plants of the Big Three just across the border in Windsor. It is expected that production of automobiles in these Canadian plants will contine despite the European war and that increased output will accompany other boosts in industrial activity in Canada unless prices of automobiles should be forced up by unusual conditions affecting labor supply and material cost. As a result of these factors, a sharp improvement in automotive machine tool requirements is looked for along the border. Already perishable tools have been ordered in large quantities, paralleling the experience on the U. S. side of the border. No indication of demand for munitions manufacturing machinery in the Ontario section exists.

Deliveries the Big Problem Chicago Sellers Report

CHICAGO—Deliveries are the big problem in this district as elsewhere and some items are being quoted as far ahead as May and June, 1940. In one case, a three months' delivery quotation was advanced to five months in two days' time. Orders are still coming in at a good rate, one sales agency anticipating a better October than September. Inquiries for both machine and small tools are maintaining good volume. Rebuilt machinery is enjoying good demand, deliveries of five to six weeks maximum making this type equipment especially attractive at this time. A recent machine tool auction realized unusually high prices. A. O. Smith Corp., Milwaukee, has a list out which includes about a dozen machines, and the Rock Island Arsenal closed on some presses this week. Price advances averaging 10 per cent have been received here recently from makers of presses, screw machines, turret lathes and grinders. A number of other lines were marked up previously. This district has seen much less Federal spending than has been the case in the East. Rockford plants are very busy on domestic and foreign orders.

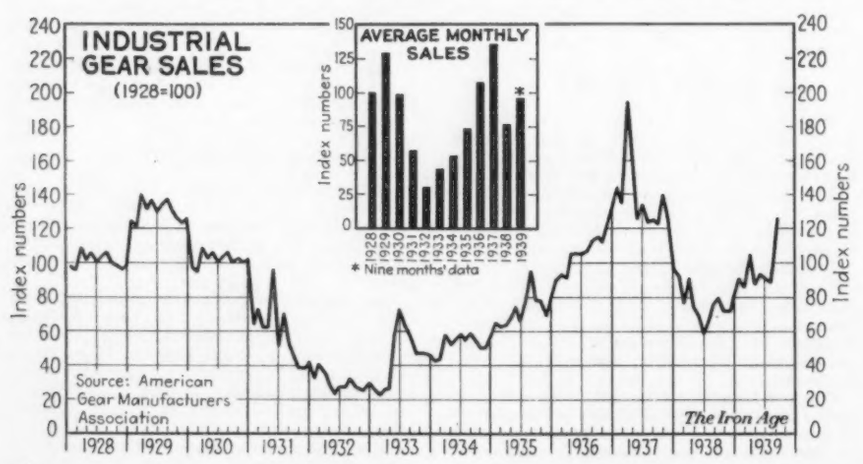
Eastern Dealers Still Swamped With Orders

NEW YORK—There has been no letup in the volume of orders that dealers here are receiving, and it appears that earlier estimates of the business placed since Sept. 5 have been too low. For one of the leading sellers this period has been the largest six weeks in sales dollar volume on record. Buyers in the East were the first to react after the declaration of war abroad and were able in the first few weeks to obtain preferred positions on delivery schedules. Dealer reactions to this situation have been heard from other centers from Buffalo west, as deliveries began to lengthen. On the other hand, the character of the business continues to be largely military. Arsenal and Navy yard buying continues heavy and the aircraft industry is still far in the van in equipment buying, as indeed it has been all year.

Price advances on machine tools shipped after Jan. 1 have been posted up to 15 per cent, and after March 1, 20 per cent by several manufacturers, but the practice is not yet general.

Gear Buying Spurts in September

SALES of industrial gears in September were 31 per cent above August and 56 per cent ahead of September, 1938, the American Gear Manufacturers Association reports. Sales in the nine months ended September showed an increase of 26 per cent over the comparable period of 1938. Automobile gears are not included in these statistics.


INDUSTRIAL GEAR SALES
(1928=100)
AVERAGE MONTHLY SALES
Index numbers
* Nine months' data
Source: American Gear Manufacturers Association
The Iron Age
1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939

AFA Publishes Book on Industrial Hygiene Codes

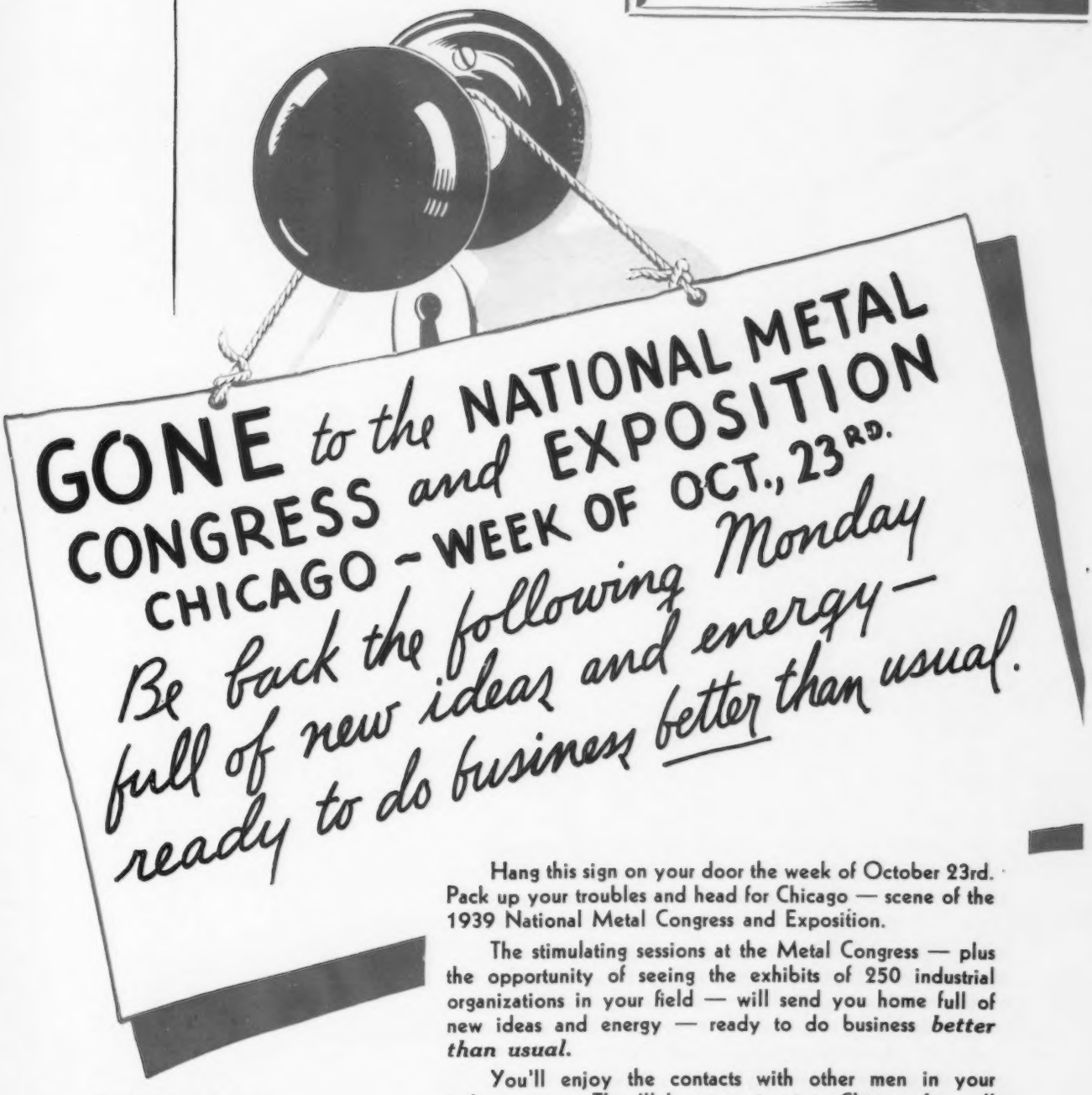
CHICAGO—The American Foundrymen's Association's committee on industrial hygiene codes has published a fourth code in its series of recommended practices.

This code covers recommended practices and installations for alkaline, solvent, solvent degreasing, metal pickling, tumbling mill and abrasive blasting cleaning processes. Pertinent information on metal cleaning in general for the prevention of accidents and minimizing exposure to occupational disease is also included.

The committee believes that this is the first time definite engineering recommendations dealing directly with the hazards involved have been published.

The code book consists of 42 pages, is illustrated with diagrams, and is priced at $2.50 a copy.

Mr. SMITH


GONE to the NATIONAL METAL CONGRESS and EXPOSITION
CHICAGO - WEEK OF OCT., 23RD.
Be back the following Monday full of new ideas and energy — ready to do business better than usual.

Hang this sign on your door the week of October 23rd. Pack up your troubles and head for Chicago — scene of the 1939 National Metal Congress and Exposition.

The stimulating sessions at the Metal Congress — plus the opportunity of seeing the exhibits of 250 industrial organizations in your field — will send you home full of new ideas and energy — ready to do business ***better than usual.***

You'll enjoy the contacts with other men in your industry, too. They'll be streaming into Chicago from all over the country — 20,000 strong — to attend this great annual event.

You had better make your plans now. For full particulars, contact any of the technical societies listed at the left,— or address W. H. Eisenman, Director, National Metal Congress and Exposition, 7016 Euclid Avenue, Cleveland, Ohio.

Co-operating Societies:
Wire Association;
American Society for Metals;
Institute of Metals Division and
Iron and Steel Division of A.I.M.E.;
American Welding Society.

National
METAL CONGRESS and EXPOSITION
INTERNATIONAL AMPHITHEATRE
CHICAGO ..... Oct. 23-27, 1939

21ST METAL CONGRESS—

DOMESTIC inactivity at home and the spirit of Munich abroad was the back-drop of last year's Metal Congress in Detroit, but the twenty-first Metal Congress next week in Chicago finds at-home production indexes reaching for new maxima and the whole world jittering on the edge of war-inspired inflation.

But despite (or because of) the war and the recent vogue for mammoth world's fairs, congresses and other expositions, the National Metal Congress, Oct. 23 through 27, shows every indication of matching the performance of past Congresses.

As in 1935 (the last time the Congress was held in Chicago), the Exposition will be housed at the International Amphitheatre, but this year with some 25 per cent more exhibitors all reserving larger individual display spaces than in 1935, the whole of the main floor will be devoted to the exhibits.

This includes the main arena with 23,000 sq. ft. of space and the entire north and south wings, each providing 57,000 sq. ft. of space—a total of well over three acres.

Spacious and commodious meeting rooms and club facilities are available in the main building itself as well as in the adjoining International Inn and Saddle and Sirloin Club.

The Exposition will be open from 12 noon until 10:30 p.m. daily Monday through Friday with the exception of Thursday, Oct. 26, when it will close at 6 p. m.

In addition to the American Society for Metals, the Iron and Steel Division and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, the American Welding Society and the Wire Association are again cooperating in next week's Congress. All of these organizations will have full programs of technical sessions, special meetings and events, complete details of which follows.

The A.S.M. program includes about 50 reports of the year's technical progress, but of particular importance to many member will be the two timely educational courses.

Under the title "Functions of the Alloying Elements in Steel," a five-lecture educational course by E. C. Bain, past president A.S.M. and assistant to the vice-president in charge of metallurgy and research, United States Steel Corp., promises to be one of the finest and most instructive in a long series of such educational courses sponsored by the A.S.M. And, another popular educational feature will be the three-lecture evening course on the subject of "Visual Examination of Steels" to be presented by George M. Enos, associate professor of metallurgy, University of Cincinnati.

Campbell Lecture by Davenport

A most significant research has been carried on in the Kearny Research Laboratories of United States Steel Corp. on the general subject of transformation rates in steel. And, one of the foremost collaborators in this work during the past decade was Edmund S. Davenport, who has been selected to deliver the Edward deMille Campbell Memorial Lecture of the A.S.M. on Wednesday morning, Oct. 25, in the ballroom of the Palmer House.

R. E. Desvernine, president of Crucible Steel Co. of America, will be the featured speaker at the annual banquet of the A.S.M. to be held at the Palmer House in Chicago on Oct. 26. With the entire business structure vitally altered by the present war in Europe, Mr. Desvernine is expected to have some extremely interesting observa-

CHICAGO—NEXT WEEK

tions to make on present industrial problems.

60 Papers for A. W. S.

The American Welding Society has provided the largest and most interesting program in its entire history. Some 60 papers covering every phase of welding will be presented.

Stevens Hotel has been selected by the Society as its headquarters. The meeting will open with a President's Reception on Sunday afternoon in the Tower Ballroom.

The keynote address will be given on Monday, Oct. 23 by David Levinger, assistant to the vice-president and works manager, Hawthorne Plant, Western Electric Co. This will be followed by the presentation of the Samuel Wylie Miller Medal for the outstanding achievement or service to the welding industry, and the Lincoln Gold Medal for the best paper presented before a section or national meeting during the past year.

Directly after the presentation of medals, the technical sessions will begin. The meeting also has some very attractive social and educational features. In addition to the President's Reception already mentioned, there is to be a stag with refreshments and entertainment on Wednesday evening. The annual banquet, at which Nathaniel Leverone will act as toastmaster, will be held on Thursday evening.

A.I.M.E. at Blackstone

The Institute of Metals and Iron and Steel Divisions of the A.I.M.E. will make the Blackstone Hotel their headquarters. Registration will begin at 9:00 a. m. Monday, Oct. 23, at the registration desk on the ballroom floor of the Blackstone. Technical sessions will open at 10:00 a. m. and continue through Wednesday afternoon.

The annual banquet of the Metals Divisions, joining with the Chicago Section of the A.I.M.E., will be in the ballroom of the Blackstone Hotel on Tuesday evening, Oct. 24. The principal after-dinner speaker will be C. M. White, vice-president in charge of operations of the Republic Steel Corp.

Mordica Lecture by Braley

Among the most interesting events scheduled on the program of the Wire Association will be the plant inspection at the Hawthorne Works of the Western Electric Co. Tuesday afternoon, Oct. 24, and the visit to the new Republic wire mill Thursday afternoon.

Headquarters for the Wire Association will be Chicago's Congress Hotel, where reservations for these plant visitations can be made at the Wire Association registration desk in the main lobby.

At the annual meeting of the Wire Association, the Mordica Memorial Lecture will be presented by S. A. Braley, chief metallurgical field engineer, rod and wire division, Pittsburgh Steel Co.

This year's Smoker will once more be under the direction of A. R. Zapp, manager of the Firthaloy Division of Firth-Sterling Steel Co., who promises a show well worth the money.

Many Inspection Trips

Plant inspection trips to a number of the leading industrial firms in the Chicago district have been arranged for the week of the Congress.

These trips are scheduled for Tuesday, Wednesday, Thursday and Friday, Oct 24, 25, 26 and 27. Buses will pick up the visitors at 8:30 each morning at the State Street entrance to the Palmer House, with the excep-

tion of the trip to Chicago Latrobe Twist Drill Co., which will be made by taxi.

A charge of $1.00 will be made for each trip. A choice of two or more excursions is available for each morning as shown in the schedule below. When two plants are located close together, plans are made to visit both on one trip.

Tuesday, Oct. 24

International Harvester Co. Tractor Works or

Acme Steel Co. and American Can Co. (Englewood Plant).

Wednesday, Oct. 25

Carnegie-Illinois Steel Co. South Works or

A. Finkl & Sons Co. and Lindberg Steel Treating Co.

Thursday, Oct. 26

Inland Steel Co. or

Mills Novelty Co., Belden Mfg. Co., and Stewart Warner Co. (any two).

Friday, Oct. 27

Youngstown Sheet & Tube Co. or

Western Electric Co. or

Chicago Latrobe Twist Drill Co.

Correlated Technical Program . . .

A.S.M., A.W.S., A.I.M.E., and W.A.

SUNDAY, OCT. 22

5:00 P.M.

President's reception, A.W.S., Tower Ballroom, lower level, Stevens Hotel.

MONDAY, OCT. 23

9:00 A.M.

A.I.M.E. Registration, Ballroom floor, Blackstone Hotel.

9:30 A.M.

Keynote address and presentation of medals, A.W.S., North Ballroom, Stevens Hotel.

Impact Properties of Some Low-Alloy Nickel Steels at Temperatures Down to −200 Deg. F., by T. N. Armstrong and A. P. Gagnebin. A.S.M., Grand Ballroom, Palmer House.

Stress-Strain Characteristics of the Torsion Impact Test, by O. V. Greene and R. D. Stout. A.S.M., Room 14, Palmer House.

10:00 A.M.

Effect of Titanium on the Macro-Structure and Grain-Coarsening Temperature of Forging Steel, by G. F. Comstock. A.S.M., Grand Ballroom, Palmer House.

Influence of Magnetic Fields on Damping Capacity, by E. R. Parker. A.S.M., Room 14, Palmer House.

Study of Action of Molten Zinc Alloys on Pressure Die Casting Equipment, by E. A. Anderson, G. Edmunds and C. W. Siller. A.I.M.E., Ballroom, Blackstone Hotel.

Nature of Passivity in Stainless Steel and Other Alloys, by H. H. Uhlig. A.I.M.E., Art Floor, Blackstone Hotel.

10:30 A.M.

Introductory Study of the Nitriding of Hardened High Speed Steel by the Use of Molten Cyanides, by J. G. Morrison and J. P. Gill. A.S.M., Grand Ballroom, Palmer House.

Interrelation Between Stress and Strain in the Tensile Test, by E. J. Janitzky and M. Baeyertz. A.S.M., Room 14, Palmer House.

Welded Structures Under the Bureau of Yards and Docks, U. S. Navy, by Commander C. A. Trexel. A.W.S., North Ballroom, Stevens Hotel.

High Strength Silicon Brass Die Casting Alloy, by Alan U. Seybolt and B. W. Gonser. A.I.M.E., Ballroom, Blackstone Hotel.

Data on Pit Foci (Stainless Steel), by R. Buehl and John Wulff. A.I.M.E., Art Floor, Blackstone Hotel.

11:00 A.M.

Some Practical Notes on High Speed Steel Forgings, by W. H. Wills. A.S.M., Grand Ballroom, Palmer House.

Fatigue Resistance of Steel as Affected by Acid Pickling, by G. L. Kehl and C. M. Offenhauer. A.S.M., Room 14, Palmer House.

Bonneville Dam Presents Varied Use of Welding, by P. L. Heslop and F. T. Downing; Also, motion pictures on Grand Coulee Dam. A.W.S., North Ballroom, Stevens Hotel.

12:15 P.M.

Institute of Metals Division, A.I.M.E., Executive Committee luncheon meeting, Observation Room, Blackstone Hotel.

Committee on the Physical Chemistry of Steelmaking, A.I.M.E., luncheon meeting. Green Room, Blackstone Hotel.

2:00 P.M.

Creep Rates From Tests of Short Duration, by J. J. Kanter and E. A. Sticha. A.S.M., International Amphitheatre.

Beneficial Effects of Zirconium in Cast Nickel-Silicon Bronzes, by F. R. Hensel, E. I. Larsen and A. S. Doty. A.I.M.E., Ballroom, Blackstone Hotel.

Magnetic Analyses of Transformations in Cold Worked 18-8 Alloy, by R. Buehl, H. Hollomon and John Wulff. A.I.M.E., Art Floor, Blackstone Hotel.

Weld Hardening of Carbon and of Alloy Steel, by H. J. French and T. N. Armstrong. A.W.S., South Ballroom, Stevens Hotel.

Welding Propeller Shaft Tubing for the Automobile Industry, by G. C. Gridley. A.W.S., North Ballroom, Stevens Hotel.

2:30 P.M.

Characteristics of 5 and 7 Per Cent Chromium Steels With Varying Molybdenum and Vanadium Content, by W. G. Hildorf, C. L. Clark and A. E. White. A.S.M., International Amphitheatre.

Characteristics of Mild Steel Welding Wire, by J. C. Joublanc. W.A., Congress Hotel.

An Investigation of the Spot Welding of Automobile Grade of Mild Steel, by W. F. Hess and R. A. Wyant. A.W.S., South Ballroom, Stevens Hotel.

Machine Welded Sheet Metal Parts for Enameling, by Joseph C. Lewis. A.W.S., North Ballroom, Stevens Hotel.

Study of the Distribution of Structural and Physical Characteristics Through the Bodies of Large Castings of Gun Metal, by A. A. Bradd. A.I.M.E., Ballroom, Blackstone Hotel.

New Instrument for the Magnetic Determination of Carbon in a Steel Bath, by H. K. Work and H. T. Clark. A.I.M.E., Art Floor, Blackstone Hotel.

3:00 P.M.

Stress Corrosion-Cracking of the Austenitic Chromium-Nickel Steels and Its Industrial Implications, by J. C. Hodge and J. L. Miller. A.S.M., International Amphitheatre.

Submerged Heat by Submerged Combustion, by Walter G. See. W.A., Congress Hotel.

Failure of Aluminum Subjected to Combined Stresses, by Joseph Marin. A.W.S., South Ballroom, Stevens Hotel.

Automatic Oxyacetylene Welding of Oil Floats, by H. E. Lerner. A.W.S., North Ballroom, Stevens Hotel.

Study of the Distribution of Structural and Physical Characteristics Through the Bodies of Large Castings of Red Bronze, by Allen M. Rahm. A.I.M.E., Ballroom, Blackstone Hotel.

Apparatus for Determining the Thermo-Magnetic Behavior of Slags and Some Preliminary Results Obtained With It, by B. A. Rogers and K. O. Stamm. A.I.M.E., Art Floor, Blackstone Hotel.

3:30 P.M.

Ferromagnetic Austenite, by L. P. Tarasov and E. R. Parker. A.S.M., International Amphitheatre.

Boulder Dam and the World's Outstanding Transmission Lines, by Dr. D. M. Simmons. A lecture with motion pictures. W.A., Congress Hotel.

Fatigue Tests of Welded Joints in Structural Plates, by W. M. Wilson and A. B. Wilder. A.W.S., South Ballroom, Stevens Hotel.

4:30 P.M.

Educational lecture course on *Functions of the Alloying Elements in Steel*, by E. C. Bain. A.S.M., International Amphitheatre.

8:00 P.M.

Educational lecture course on *Visual Examination of Steels—Macroscopic Technique*, by G. M. Enos. A.S.M., International Amphitheatre.

TUESDAY, OCT. 24

9:30 A.M.

Analysis of Machineability Data From Cold Finished and Heat Treated

S.A.E. 1045 Steel, by O. W. Boston and W. W. Gilbert. A.S.M., Grand Ballroom, Palmer House.

Annealing of Low-Carbon Rimmed, Aluminum-Killed and Silicon-Killed Steels, by W. P. Wallace and R. L. Rickett. A.S.M., Room 14, Palmer House.

Reactions in Arc Welding, by R. D. Thomas, Jr., and F. H. Rhodes. A.W.S., South Ballroom, Stevens Hotel.

Use of Steel Castings and Rolled Steel Plate in Welded Fabrication, by H. J. Shiffli and E. L. Krejci. A.W.S., North Ballroom, Stevens Hotel.

Engineering of Continuous Strand Equipment, by R. R. Tatnall. W. A., Congress Hotel.

Coating Wire With Paper Pulp, by J. S. Little. W.A., Congress Hotel.

10:00 A.M.

Discussion of Leaded Steels, by F. J. Robbins and G. R. Caskey. A.S.M., Grand Ballroom, Palmer House.

Prevention of Flakes by Holding Railroad Rails at Various Constant Temperatures, by R. C. Cramer and E. C. Bast. A.S.M., Room 14, Palmer House.

Plate Edge Preparation for Welding, by H. E. Rockefeller. A.W.S., North Ballroom, Stevens Hotel.

Arc Welding in Controlled Atmospheres, by G. E. Doan. A.W.S., South Ballroom, Stevens Hotel.

Structure of Aluminum After Compression, by C. S. Barrett and L. H. Levenson. A.I.M.E., Ballroom, Blackstone Hotel.

Solubility of Nitrogen in Molten Iron-Silicon Alloys, by J. C. Vaughan and John Chipman. A.I.M.E., Art Floor, Blackstone Hotel.

Brazing of Copper, by L. L. Wyman. W. A., Congress Hotel.

Manufacture of Swedish Steel Rods, a motion picture by Uddeholm Co. of America. W.A., Congress Hotel.

10:30 A.M.

Precipitation Hardening Characteristics of High Purity Aluminum-Copper and Aluminum-Copper-Iron Alloys, by H. Y. Hunsicker. A. S. M., Grand Ballroom, Palmer House.

Selection of Steel and Heat-Treatment For Spur Gears, by H. B. Knowlton and E. H. Snyder. A.S.M., Room 14, Palmer House.

Effect of Alloying in Metallic Arc Welding, by R. W. Emerson. A.W.S., South Ballroom, Stevens Hotel.

Flow of Materials in Production Welding, by W. W. Petry. A.W.S., North Ballroom, Stevens Hotel.

Recrystallization of Lead, by Paul A. Beck. A.I.M.E., Ballroom, Blackstone Hotel.

Studies of Erosion of Guns, by Peter R. Kosting. A.I.M.E., Art Floor, Blackstone Hotel.

11:00 A.M.

Manganese in Rutile-Type Coated Steel Electrodes, by E. G. Enck. A.W.S., South Ballroom, Stevens Hotel.

Welding Heavy Presses, by L. J. McDonough and J. R. Henry. A.W.S., North Ballroom, Stevens Hotel.

Metallography of Tin and Zinc Coatings on Steel, by O. E. Romig and D. H. Rowland. A.I.M.E., Art Floor, Blackstone Hotel.

Tensile Deformation of Critically Oriented Brass Crystals, by H. L. Burghoff. A.I.M.E., Ballroom, Blackstone Hotel.

Drawing of Aluminum, by L. J. Weber and J. T. Weinzierl. A.S.M., Grand Ballroom, Palmer House.

11:30 A.M.

Creep Tests of Arc-Welded Low-Carbon Steel, by N. F. Ward. A.W.S., South Ballroom, Stevens Hotel.

12:15 P.M.

Open Hearth Executive Committee, A.I.M.E., luncheon meeting, Observation Room, Blackstone Hotel.

1:30 P.M.

Visit to Hawthorne Works of General Electric Co. W.A., leaving from Congress Hotel.

2:00 P.M.

Time Quenching, by J. L. Burns and Victor Brown. A.S.M., International Amphitheatre.

Further Studies of the Spot Welding of Low-Carbon Stainless Steel, by W. F. Hess and R. A. Wyant. A.W.S., South Ballroom, Stevens Hotel.

Fabrication of Road Building Equipment, by L. L. Burger. A.W.S., North Ballroom, Stevens Hotel.

Constitution and Microstructure of Copper-Rich Silicon-Copper Alloys, by C. S. Smith, A.I.M.E., Ballroom, Blackstone Hotel.

Desulphurization of Pig Iron With Calcium Carbide, by C. E. Wood, E. P. Barrett, and W. F. Holbrook. A.I.M.E., Art Floor, Blackstone Hotel.

E. C. BAIN

Who Will Present a Five-Lecture Course on "Functions of Alloying Elements in Steel".

2:30 P.M.

Test Method for the Evaluation of Aqueous Quenching Media for Steel Hardening, by F. W. Trembour and Howard Scott. A.S.M., International Amphitheatre.

Application of Proximity Effect to Welding, by E. Bennett. A.W.S., South Ballroom, Stevens Hotel.

Designing Construction Machinery for Production by Welding, by H. C. Hettelsater. A.W.S., North Ballroom, Stevens Hotel.

Alpha Solubility Limit and the First Intermediary Phase in the Copper-Silicon System, by A. G. H. Anderson. A.I.M.E., Ballroom, Blackstone Hotel.

Reduction of Iron Ores Under Pressure by Carbon Monoxide, by M. Tenenbaum and T. L. Joseph. A.I.M.E., Art Floor, Blackstone Hotel.

3:00 P.M.

Contact Resistance, by F. J. Studer. A.W.S., South Ballroom, Stevens Hotel.

Cutting and Welding Stainless Clad Steel, by W. B. Keelor. A.W.S., North Ballroom, Stevens Hotel.

Hardenability Variations in Alloy Steels: Some Investigations With the End-Quench Test, by G. T. Williams. A.S.M., International Amphitheatre.

Simple Method of Thermal Analysis Permitting Quantitative Measurements of Specific and Latent Heats, by C. S. Smith. A.I.M.E., Ballroom, Blackstone Hotel.

Graphitization of Cementite in Cupola White Iron, by N. A. Ziegler, W. L. Meinhart and A. J. Deacon. A.I.M.E., Art Floor, Blackstone Hotel.

3:30 P.M.

A Hardenability Test for Shallow Hardening Steels, by W. E. Jominy. A.S.M., International Amphitheatre.

Weld Inspection by Means of Trepanned Plugs, by W. T. Tiffin. A.W.S., South Ballroom, Stevens Hotel.

Large Equipment Fabrication, by Leslie McPhee. A.W.S., North Ballroom, Stevens Hotel.

4:00 P.M.

Welding of Copper, by A. P. Young. A.W.S., South Ballroom, Stevens Hotel.

4:30 P.M.

Educational lecture course on *Functions of the Alloying Elements in Steel*, by E. C. Bain. A.S.M., International Amphitheatre.

6:15 P.M.

Saddle and Sirloin Club, Stockyard Inn, Missouri School of Mines and Metallurgy, Alumni Dinner.

7:00 P.M.

A.I.M.E. cocktail party, Ballroom floor, Blackstone Hotel.

8:00 P.M.

Educational lecture course on *Visual Examination of Steels—Macro Etching*, by G. M. Enos. A.S.M., International Amphitheatre.

A.I.M.E. annual autumn dinner. C. M. White, vice-president in charge of operations of Republic Steel Corp. will speak on "Citizenship."

WEDNESDAY, OCT. 25

9:30 A.M.

Annual meeting of American Society for Metals, Grand Ballroom, Palmer House.

Edward DeMille Campbell Memorial Lecture, by E. S. Davenport, A.S.M., Grand Ballroom.

Some Applications of the Resistance Welding Process, by C. L. Pfeiffer. A.W.S., North Ballroom, Stevens Hotel.

Flame Hardening the Way Surfaces of Machine Tools, by F. C. Dull. A.W.S., South Ballroom, Stevens Hotel.

Atmospheric Annealing of Steel Wire, by Dr. Allan Bates and John Gier. W.A., Congress Hotel.

Electric Resistance Wires, by Dr. C. L. Mantell. W.A., Congress Hotel.

10:00 A.M.

Hard Facing by Fusion Welding, by T. B. Jefferson. A.W.S., South Ballroom, Stevens Hotel.

Precision Welding by the Resistance Method, by E. J. Bates, G. J. Oswald and R. L. Hous. A.W.S., North Ballroom, Stevens Hotel.

Manufacture and Use of Stainless Steel Wire, by S. P. Watkins. W.A., Congress Hotel.

Manufacture and Uses of Wire Solder, by R. A. Gardiner. W.A., Congress Hotel.

10:30 A.M.

Effect of Hardness and of Temperature on the Strength, Ductility and Toughness of a Heat Treated Carbon Steel, by S. W. Lyon. A.S.M., Grand Ballroom, Palmer House.

Flame Treating, by J. H. Zimmerman. A.W.S., South Ballroom, Stevens Hotel.

Spot Welding of Aluminum, by R. Kauffmann. A.W.S., North Ballroom, Stevens Hotel.

11:00 A.M.

Hardness Characteristics of Some Medium Carbon S.A.E. Steels, by P. Klain and C. H. Lorig. A.S.M., Grand Ballroom, Palmer House.

Flame Hardening from the Standpoint of the Commercial Heat Treater, by W. G. Hamilton. A.W.S., South Ballroom, Stevens Hotel.

Some Studies of Flash Welding, by M. G. Yatsevitch. A.W.S., North Ballroom, Stevens Hotel.

11:30 A.M.

Accelerating Effect of Certain Metallic Elements on Graphitization, by H. A.

Schwartz, V. Fiordalis, J. L. Fisher, J. F. Shumar and M. J. Trinter. A.S.M., Grand Ballroom, Palmer House.

12:15 P.M.

A.I.M.E. Iron and Steel Division, Executive Committee luncheon meeting, Observation Room, Blackstone Hotel.

1:00 P.M.

Wire Association luncheon, to which members and guests of all societies invited. Guest speaker Major Gen. J. O. Mauborgne, chief signal officer of the U. S. Army, speaking on matters of national interest pertinent to the wire industry. Congress Hotel.

2:00 P.M.

Transformation of Austenite on Quenching High Purity Iron-Carbon Alloys, by T. G. Digges. A.S.M., International Amphitheatre.

Tensile Properties of Rolled Magnesium Alloys I. Binary Alloys With Aluminum, Antimony, Bismuth, Cadmium, Copper, Lead, Nickel, Silver, Thallium, Tin and Zinc, by John C. McDonald. A.I.M.E., Ballroom, Blackstone Hotel.

Welding of Boiler Drums and Pressure Vessels, by R. T. Kernoll. A.W.S., South Ballroom, Stevens Hotel.

Engineering Fundamentals of Resistance Welding, by S. M. Humphrey. A.W.S., North Ballroom, Stevens Hotel.

2:30 P.M.

Kinetics of the Austenite-Martensite Transformation in Steel, by A. B. Greninger and A. R. Troiano. A.S.M., International Amphitheatre.

Oxyacetylene Welding Red Brass Pipe, by A. N. Kugler. A.W.S., South Ballroom, Stevens Hotel.

High Speed Welding Assemblies, by E. W. Forkner. A.W.S., North Ballroom, Stevens Hotel.

Copper Embrittlement, IV, by L. L. Wyman. A.I.M.E., Ballroom, Blackstone Hotel.

3:00 P.M.

Mechanical Properties of the Isothermal Decomposition Products of Austenite, by M. Gensamer, E. B. Pearsall and G. V. Smith. A.S.M., International Amphitheatre.

Annual meeting of Wire Association. Merdica Memorial Lecture, *Correlation of the Factors and Effects of Cold Drawing of Wire Rods*, by Dr. S. A. Braley. Congress Hotel.

90 Deg. Welded Nozzles, Piping—Calculations, Design and Fabrication, by F. C. Fantz and W. G. Hooper. A.W.S., South Ballroom, Stevens Hotel.

Application and Use of Portable Spot Welders, by C. E. Heitman. A.W.S., North Ballroom, Stevens Hotel.

Effect of Composition Upon the Physical and Chemical Properties of 10K Gold Alloys, by T. C. Jarrett. A.I.M.E., Ballroom, Blackstone Hotel.

3:30 P.M.

Spheroidizing of Steel by Isothermal Transformation, by P. Payson, W. Hodapp and J. Leeder. A.S.M., International Amphitheatre.

Extensions of Fusion Welding in Special Pipe and Pipe Fitting Applications, by E. H. Taylor. A.W.S., South Ballroom, Stevens Hotel.

Latest Developments in Resistance Welding, by R. T. Gillette. A.W.S., North Ballroom, Stevens Hotel.

4:30 P.M.

Educational lecture course on *Functions of the Alloying Elements in Steel*, by E. C. Bain. A.S.M., International Amphitheatre.

7:30 P.M.

Annual dinner and stag smoker of Wire Association, Congress Hotel.

8:00 P.M.

Educational lecture course on *Visual Examination of Steels—Other Methods of Testing*, by G. M. Enos. A.S.M., International Amphitheatre.

E. S. DAVENPORT

Edward DeMille Campbell Memorial Lecturer.

10:00 P.M.

Stag party of American Welding Society, Boulevard Room, Stevens Hotel.

THURSDAY, OCT. 26

9:30 A.M.

Bright Hardening of Tool Steels Without Decarburization or Distortion, by J. R. Gier and Howard Scott. A.S.M., Grand Ballroom, Palmer House.

The Nickel-Tungsten System, by F. H. Ellinger and W. P. Sykes. A.S.M., Room 14, Palmer House.

Repairs to Castings and Other Steel Mill Parts, by S. S. Baumer. A.W.S., South Ballroom, Stevens Hotel.

High Spots in Ship Welding, by E. D. Debes. A.W.S., North Ballroom, Stevens Hotel.

Symposium, *Disposal of Waste Acid*, W.A., Congress Hotel.

10:00 A.M.

Hardness Conversion Relations for Hardened Steels, by H. Scott and T. H. Gray. A.S.M., Grand Ballroom, Palmer House.

Effect of Humidity of Air on the Oxidation of a Low-Carbon Steel, by C. A. Siebert and H. G. Donnelly. A.S.M., Room 14, Palmer House.

Welding in a Steel Mill, by R. P. Palmer. A.W.S., South Ballroom, Stevens Hotel.

Designing Welded Frames for Continuity, by B. Johnston and E. H. Mount. A.W.S., North Ballroom, Stevens Hotel.

10:30 A.M.

Hardenability Studies on Tool Steels, by A. J. Scheid, Jr. A.S.M., Grand Ballroom, Palmer House.

Heat Etching as a Means of Revealing Austenite Grain Size, by M. J. Day and J. B. Austin. A.S.M., Room 14, Palmer House.

Flame Descaling and Flame Cleaning and Dehydrating, by J. G. Magrath. A.W.S., South Ballroom, Stevens Hotel.

Design and Fabrication of Welded Structures, by C. E. Loos and F. H. Dill. A.W.S., North Ballroom, Stevens Hotel.

11:00 A.M.

Tempering of High Speed Steel, by Morris Cohen and P. K. Koh. A.S.M., Room 14, Palmer House.

Present Day Practice in Structural Welding, by A. L. Wilson. A.W.S., North Ballroom, Stevens Hotel.

1:30 P.M.

Visit to Republic Steel Corp. wire mill, W.A., leaving from Congress Hotel.

2:00 P.M.

Symposium on Precipitation Hardening (Age Hardening) of Metals: *Introduction to Precipitation Hardening*, by Zay Jeffries; *Application of Solid Solution and Precipitation Hardening Effects in Aluminum Alloys*, by L. W. Kempf; *Precipitation Hardening of High Purity Binary and Ternary Aluminum-Copper Alloys*, by W. L. Fink, D. W. Smith and L. A. Willey; *Precipitation Hardening in the Heavy Alloys*, by W. P. Sykes. A.S.M., International Amphitheatre.

4:30 P.M.

Educational lecture course on *Functions of the Alloying Elements in Steel*, by E. C. Bain. A.S.M., International Amphitheatre.

7:00 P.M.

Annual dinner of American Society for Metals, all societies, Palmer House. Speaker, R. E. Desvernine, president of Crucible Steel Co. of America.

10:00 P.M.

Annual banquet and dance of American Welding Society. Boulevard Room, Stevens Hotel.

FRIDAY, OCT. 27

8:30 A.M.

Educational lecture course on *Functions of the Alloying Elements in Steel*, by E. C. Bain. A.S.M., Room 14, Palmer House.

9:30 A.M.

Symposium on Precipitation Hardening (Age Hardening) of Metals: *Age-Hardening Copper Alloys*, by D. K. Crampton; *Age-Hardening of a Copper-Cobalt and a Copper-Iron Alloy*, by R. B. Gordon; *Age-Hardening Precious Metal Alloys*, by R. F. Vines and E. M. Wise; *Dispersion Hardening Alloys of Nickel and Iron-Nickel-Titanium*, by N. B. Pilling and A. M. Talbot; *Aging in Iron and Steel*, by R. L. Kenyon and R. S. Burns. A.S.M., Grand Ballroom, Palmer House.

Maintenance of Way Welding, by C. E. Morgan. A.W.S., North Ballroom, Stevens Hotel.

A Study of Heat Effects in Welding, by Dr. W. A. Pearl. A.W.S., South Ballroom, Stevens Hotel.

10:00 A.M.

Welding in the Manufacture of Valves for High Pressures and Temperatures, by W. F. Crawford and L. H. Carr. A.W.S., South Ballroom, Stevens Hotel.

Automatic Welding in the Design and Construction of Railroad Rolling Stock, by F. C. Hasse. A.W.S., North Ballroom, Stevens Hotel.

10:30 A.M.

Shrinkage of Steel to Correct Distortion from Welding and Forging, by S. T. Smetters. A.W.S., South Ballroom, Stevens Hotel.

Production Panel Welding of Freight and Passenger Cars, by J. W. Sheffer. A.W.S., North Ballroom, Stevens Hotel.

2:00 P.M.

Inspection trip to Electro-Motive Corp. plant, La Grange, Ill., by members of A.W.S. Leave from Stevens Hotel.

Symposium on Precipitation Hardening (Age Hardening) of Metals: *The Role of Strain in Precipitation Reactions in Alloys*, by R. H. Harrington; *Mechanism of Precipitation From Solid Solution, The Theory of Age-Hardening*, by R. F. Mehl and L. K. Jetter. A.S.M., International Amphitheatre.

JUST BETWEEN US TWO

Invitation

Please regard this as your invitation to visit us at the National Metal Show in Chicago next week. Our booth will be No. M-325. It will be slightly less elaborate than, say, the General Motors exhibit at the World's Fair, but we can promise there will be no waiting in line.

Stalemate

Publishers' booths, as a whole, are among the less exciting features of trade expositions, and what to do to enliven ours has been given more than passing consideration by many of your favorite family journal's best minds.

The Oberleutnant might be shown defying a superlative, with a suitable build-up, the way the G-E people do in their man-made lightning exhibit. Or a half dozen or so editors might be displayed in the throes of creation. The only trouble with that is that none of our editors types with his hat on the back of his head and smokes a corncob pipe the way they do in the movies. Therefore, they lack authenticity.

And even at best, watching editors at work ranks low as a spectator sport, so we will have to think of something else.

Violet Shows Teeth

Because of the Oberleutnant's pathological aversion to superlatives, thousands, we might even say dozens—with a bow to Benchley—of bouquets die unused on our hands.

Maybe the Oberleutnant is right in believing that modesty is appreciated, but we worry about it sometimes, and most of all when we run across a Buick ad. Buick conceals its virtues with such inhibited phrases as:

> *". . . a big beautiful brawny car styled to knock your eye out . . . a car that positively glitters in its brilliance of action . . . a marvelously engin ered chassis . . . surging, soaring, millrace power . . . Buick at its unbeatable best . . . a miracle of animate precision."*

When better adjectives are coined, Buick will use them, but Buick sells a lot of cars, and if we are too modest to toot our own horn maybe we should at least let encomiums like these, bestowed by loving friends, see the light of day:

> ***"I find The Iron Age invaluable in keeping abreast of the fast moving developments in the industry."***
> ***"Tried to get along without it, but can't. Send it again."***
> ***"Your articles on . . . are the most intelligent we have yet encountered."***
> ***"The Iron Age is part of our lives."***

Sugaring the Honey

Sometimes superlatives defeat their own purpose. Qualifiers can weaken the effect. Take, for instance, this legend on the cover of a booklet just received from Canada, *"Printer to the King's Most Excellent Majesty."* It gives the impression of straining to prove something.

Oftentimes the simplest statement is strongest. The admission of varying degrees can be damaging, as for example, "Is so-and-so truthful?" "Yes, frequently."

Rosy All Over

A. W. Miller, who is compiling a glossary of picturesque terms used in industry, writes that a space the painter has failed to cover is known as a "holiday."

Bill ("On the Assembly Line," see page 65) Sherman, our Detroit editor, contributes this:

"Airplane 'dope' is subject to a strange effect if chilled. No matter what the color, it gets a whitish look, like a coating of frost. This phenomenon is ordinarily known as 'blushing.'

"Therefore, in aircraft plants, you will hear the expression, with never a hint of a smile, 'Look at the dope blush.'"

We Withdraw a Retraction

Which reminds us that maybe we were too hasty in beating our breast about that claim to priority for the sealed beam headlamp story. We checked further and find Bill had it in his July 20 "On the Assembly Line." So we retract our apology and reach for the liniment.

Stoppers

5 Years on Suicide Row!—Allis-Chalmers
Four Years in a Paint Mist—New Departure
Take the Handcuffs off your Heater—Morgan Construction

Puzzles

Last week's tumblers of milk and water lost identical quantities of their original contents.

If you can punctuate and explain the following you are a better man than Philetas, the noted grammarian, who died of chagrin because he couldn't solve it:

> *If you say of yourself "I lie" and in so saying tell the truth you lie if you say "I lie" and in so saying tell a lie you tell the truth.*
>
> —A. H. D.

7 money saving features

Nazel Forging Hammers are entirely self-contained units . . . need no separate motor, compressor, air storage tank or piping . . . can be placed anywhere that current is available . . . can be operated independently any hour of the day or night.

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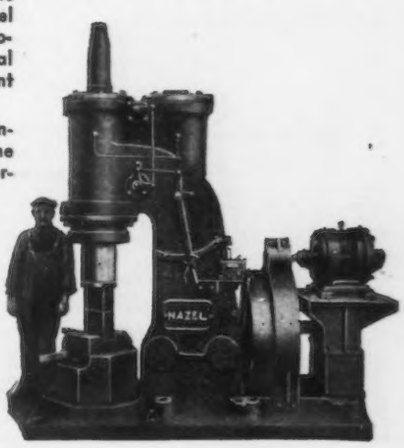
4. POSITIVE IN ACTION!
5. SIMPLY CONTROLLED!
6. HEAVY, RIGID, DURABLE CONSTRUCTION!
7. EFFICIENT — Fewer reheats, less labor and lower costs!



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PRODUCTS INDEX

WHO MAKES IT

Here you find a weekly listing of hundreds of products with the names and addresses of manufacturers. The advertisements of these companies appear in The Iron Age.

ABRASIVE CLOTH & PAPER
Norton Co., Worcester, Mass.

ABRASIVE WHEELS — See Grinding Wheels

ABRASIVES—Polishing
General Abrasive Co., Inc., Niagara Falls, N. Y.

ABRASIVES—Steel Shot and Grit
American Foundry Equipment Co., The, 510 S. Byrkit St., Mishawaka, Ind.
Harrison Abrasive Corp., Manchester, N. H.
Pangborn Corporation, Hagerstown, Md.
Pittsburgh (Pa.) Crushed Steel Co.
Steel Shot & Grit Co., Boston, Mass.

ACCESSORIES—Welding
Lincoln Electric Co., The, Cleveland.

ACCUMULATORS—Air Hydraulic
Schloemann Engineering Corp., Pittsburgh.

ACCUMULATORS—Hydraulic
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Watson-Stillman Co., The, 103 Aldene Road, Roselle, N. J.
Wood, R. D., & Co., Philadelphia.

ACETYLENE—Dissolved in Cylinders & Small Tanks
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Products Company, The, 30 East 42nd St., N. Y. C.

ACID-PROOF CEMENT
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

ACIDS—Pickling
American Chemical Paint Co., Ambler, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

AIR CONDITIONING EQUIPMENT
American Blower Corp., 6000 Russell St., Detroit.

ALLOYS—Copper
American Brass Co., The, Waterbury, Conn.
Mallory, P. R., & Co., Inc., Indianapolis, Ind.

ALLOYS—Ferro
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Magnesium
American Magnesium Corp., 1701 Gulf Bldg., Pittsburgh.
Dow Chemical Co., The, 921 Jefferson Ave., Midland, Mich.

ALLOYS—Tungsten
Vanadium Corp. of America, 420 Lexington Ave., N. Y. C.

ALLOYS—Vanadium
Vanadium Corp. of America, 420 Lexington Ave., N. Y. C.

ALLOYS—Zinc Base Die Casting
New Jersey Zinc Co., The, 160 Front St., N. Y. C.

ALUMINUM
Aluminum Co. of America, Pittsburgh.

AMMETERS & VOLTMETERS
General Electric Co., Schenectady, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.

AMMETERS AND VOLTMETERS—Recording
Leeds & Northrup Co., 4956 Stenton Ave., Philadelphia.

AMMONIA RECOVERY PLANTS
Koppers Co., Engineering & Construction Div., Pittsburgh.

ANGLES, BEAMS, CHANNELS AND TEES
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully Steel Products Co. (U. S. Stee Corp. Subsidiary), Chicago
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

ANGLES, BEAMS, CHANNELS & TEES —Magnesium Alloys
Dow Chemical Co., The, 921 Jefferson Ave., Midland, Mich.

ANNEALING—See Heat Treating

ANNEALING BOXES
Lebanon (Pa.) Steel Foundry.
United Engineering & Fdry. Co., Ptgh.

ANNEALING COVERS
Surface Combustion Corporation, 2375 Dorr St., Toledo.

ANODES—Lead
National Lead Co., 111 Bdway., N. Y. C.

APPAREL—Welding
Lincoln Electric Co., The, Cleveland.

ARBORS
Cincinnati (Ohio) Milling Mch. Co., The.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

ARRESTERS—Spark
Harrington & King Perforating Co., Chicago.

ASBESTOS
Carey, Philip, Co., The, Cincinnati, Ohio.
Johns-Manville Corp., 22 East 40th St., N. Y. C.

ASSEMBLIES
National Sewing Machine Co., Belvidere, Ill.

AXLES—Car or Locomotive
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.

BABBITT METALS
Bunting Brass & Bronze Co., The, Toledo, Ohio.
Cadman, A. W., Mfg. Co., Pittsburgh.
Cramp Brass & Iron Foundries Co., Philadelphia.
Gardiner Metal Co., 4884 S. Campbell Ave., Chicago.
National Lead Co., 111 Bdway., N. Y. C.

BALANCING EQUIPMENT
Sundstrand Machine Tool Co., Rockford, Ill.

BALANCING MACHINES — Static Dynamic
Gisholt Machine Co., Madison, Wis.

BALING PRESSES—Scrap — See Presses —Baling

BALLS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn.) Steel Ball Co., The.

BALLS—Steel, Brass or Bronze
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn.) Steel Ball Co., The.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BANDS—Steel
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BARRELS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.

BARRELS—Tumbling
Baird Mch. Co., The, Bridgeport, Conn.
Hartford (Conn.) Steel Ball Co., The.
Whiting Corp., Harvey, Ill.

BARS—Alloy
Midvale Co., The, Nicetown, Phila., Pa.
Republic Steel Corp., Cleveland, Ohio.

BARS—Aluminum
Aluminum Co. of America, Pittsburgh.

BARS—Brass, Bronze or Copper
Bunting Brass & Bronze Co., Toledo, Ohio.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.

BARS—Cold Drawn
American Steel & Wire Co. (U. S. Steel Corp. Subsidiary), Cleveland.
Bliss & Laughlin, Inc., Harvey, Ill.; Buffalo, N. Y.
Jones & Laughlin Steel Corp., Pittsburgh.
Monarch Steel Co., Indianapolis, Ind.
Union Drawn Steel Div. Republic Steel Corp., Massillon, Ohio.

BARS—Concrete, Reinforcing
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Jones & Laughlin Steel Corp., Pittsburgh.
Laclede Steel Co., St. Louis, Mo.
Nicetown Plate Washer Co., Inc., Philadelphia.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BARS—Magnesium Alloys
American Magnesium Corp., 1701 Gulf Bldg., Pittsburgh.
Dow Chemical Co., The, 921 Jefferson Ave., Midland, Mich.

BARS—Rustless
Midvale Co., The, Nicetown, Phila., Pa.
Rustless Iron & Steel Corp., Baltimore, Md.

BARS—Steel
Bethlehem (Pa.) Steel Company.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Great Lakes Steel Corp., Ecorse, Detroit
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
LaSalle Steel Co., Chicago.
Monarch Steel Co., Indianapolis, Ind.
Republic Steel Corp., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully Steel Products Co. (U. S. Steel Corp. Subsidiary), Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Youngstown (Ohio) Sheet & Tube Co., The

BATTERIES—Storage
Electric Storage Battery Co., The, Phila.

BATTERY CHARGERS
Cutler-Hammer, Inc., Milwaukee.

BEAMS—See Angles, Beams, Channels and Tees

BEARINGS—Babbitt
Bunting Brass & Bronze Co., The, Toledo, Ohio.
Cadman, A. W., Mfg. Co., Pittsburgh.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.

BEARINGS—Ball
Bantam Bearings Corp., The, South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.

BEARINGS, Brass and Bronze
Ampco Metal, Inc., Milwaukee, Wisc.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.
National Bearing Metals Corp., Pittsburgh.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS—Oilless
Bunting Brass & Bronze Co., Toledo, O.
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.

BEARINGS—Quill
Bantam Bearings Corp., The, South Bend, Ind.

BEARINGS—Radial
Bantam Bearings Corp., The, South Bend, Ind.
Bower Roller Bearing Co., Detroit, Mich.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Bearings Div. General Motors Sales Corp., Newark, N. J.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y

BEARINGS—Roll Neck
Bantam Bearings Corp., The, South Bend, Ind.
Morgan Construction Co., Worcester, Mass
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., The, Canton O.

BEARINGS—Roller
Bantam Bearings Corp., The, South Bend Ind.
Bower Roller Bearing Co., Detroit, Mich.
Hyatt Bearings Div. General Motors Sales Corp., Newark, N. J.
Link-Belt Co., 519 North Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Roller Tapered
Bantam Bearings Corp., The, South Bend, Ind.
Bower Roller Bearing Co., Detroit, Mich.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Rolling Mill Equipment
Bantam Bearings Corp., The, South Bend, Ind.
Morgan Construction Co., Worcester, Mass.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Shaft Hanger
Hyatt Bearings Div. General Motors Sales Corp., Newark, N. J.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BEARINGS—Thrust
Bantam Bearings Corp., The, South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Bearings Div. General Motors Sales Corp., Newark, N. J.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Timken Roller Bearing Co., The, Canton, O.

BELT—Conveyor, Elevator
Goodrich, B. F., Co., The, Akron, Ohio.
Hewitt Rubber Corp., Buffalo, N. Y.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan Inc., The, 2 Townsend St., Passaic, N. J.

BELTING—Leather
Chicago (Ill.) Rawhide Mfg. Co., The, 1306 Elston Ave.

BELTING—Metal, Conveyor, High and Low Temperature
Wickwire Spencer Steel Co., 500 Fifth Ave., N. Y. C.

BELTING—Rubber
Goodrich, B. F., Co., The, Akron, Ohio.
Hewitt Rubber Corp., Buffalo, N. Y.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan Inc., The, 2 Townsend St., Passaic, N. J.

BELTS—V-Type
Allis-Chalmers Mfg. Co., Milwaukee.
Goodrich, B. F., Co., The, Akron, Ohio.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan Inc., The, 2 Townsend St., Passaic, N. J.

BENCH LEGS—Steel
New Britain-Gridley Machine Div., The New Britain Machine Co., New Britain, Conn.

BENDING MACHINES—Hand, Band and Angle
Excelsior Tool & Mch. Co., E. St. Louis, Ill.

BENDING MACHINES—Hand and Power
Buffalo (N. Y.) Forge Co., 492 Broadway.
Cincinnati (Ohio) Shaper Co., The.
Cleveland (Ohio) Punch & Shear Works Co., The.
Niagara Machine & Tool Works, Buffalo, N. Y.

BENZOL RECOVERY PLANTS
Koppers Co., Engineering & Construction Div., Pittsburgh.

BERYLLIUM COPPER
American Brass Co., The, Waterbury, Conn.

BILLETS—Alloy
Harrisburg (Pa.) Steel Corp.
Midvale Co., The, Nicetown, Phila., Pa.

BILLETS—Alloy Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Carbon
Harrisburg (Pa.) Steel Corp.

BILLETS—Carbon Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Nickel Steel
Rustless Iron & Steel Corp., Baltimore, Md.

BILLETS—Chrome Steel
Rustless Iron & Steel Corp., Baltimore, Md.